

Generic

Attached Payloads Verification Plan

International Space Station Program

August 4, 2000

TYPE 1 – APPROVED BY NASA

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas
Contract No. NAS15-10000 (DR PA24)



Revision and History Page

REV.	DESCRIPTION	PUB. DATE
-	Initial Release per SSCD 003773 eff. 9-19-00 in accordance with DR PA24	10-06-00

ERU: Mary C. Nooney 10-6-00

**INTERNATIONAL SPACE STATION PROGRAM
GENERIC ATTACHED PAYLOADS VERIFICATION PLAN
AUGUST 4, 2000**

PREFACE

This document describes all of the design interface and human factors verification activities necessary to satisfy requirements contained in SSP 57003, Attached Payloads Interface Requirements Document (IRD), for the International Space Station (ISS) Program. This document encompasses all Attached Payloads to be placed on-board the ISS at six external attach sites on the Integrated Truss Assembly (ITA).

This document contains instructions, definitions, references, and guidelines for creating a unique Payload Verification Plan (PVP) that is specifically tailored to verify the interface compatibility of actual as-built payload hardware and software. This document is under the control of the Space Station Payload Control Board, and the Payload Office Manager must approve any changes or revisions.

APPROVED BY: /s/ R.W. Nygren

Rick Nygren
Manager, Space Station Payloads Office
NASA/OZ

INTERNATIONAL SPACE STATION PROGRAM
GENERIC ATTACHED PAYLOADS VERIFICATION PLAN

AUGUST 4, 2000

CONCURRENCE

PREPARED BY:	<u>Charles Moon</u>	<u>Boeing/TBE</u>
	PRINT NAME	ORGN
	<u>/s/ Charles Moon</u>	<u>8/7/00</u>
	SIGNATURE	DATE
CHECKED BY:	<u>Mike Soutullo</u>	<u>Boeing/TBE</u>
	PRINT NAME	ORGN
	<u>/s/ Mike Soutullo</u>	<u>8/7/00</u>
	SIGNATURE	DATED
SUPERVISED BY:	<u>Mike Olson</u>	<u>Boeing</u>
	PRINT NAME	ORGN
	<u>/s/ Michael Olson</u>	<u>8/7/00</u>
	SIGNATURE	DATE
SUPERVISED BY:	<u>Mo Saiidi</u>	<u>Boeing</u>
	PRINT NAME	ORGN
	<u>/s/ Mo Saiidi</u>	<u>8/7/00</u>
	SIGNATURE	DATE
CONCURRED BY:	<u>Gene Cook</u>	<u>NASA/OZ3</u>
	PRINT NAME	ORGN
	<u>/s/ Gene Cook</u>	<u>8/7/00</u>
	SIGNATURE	DATE
DQA:	<u>David Henderson</u>	<u>Boeing</u>
	PRINT NAME	ORGN
	<u>/s/ David M. Henderson</u>	<u>8/8/00</u>
	SIGNATURE	DATE

**INTERNATIONAL SPACE STATION PROGRAM
GENERIC ATTACHED PAYLOADS VERIFICATION PLAN**

August 4, 2000

All changes to paragraphs, tables, and figures in this document are shown below:

SSCBD	ENTRY DATECHANGE	PARAGRAPH(S)
--------------	-------------------------	---------------------

TABLE(S)

FIGURE(S)

APPENDIX(ES)

ADDENDA

TABLE OF CONTENTS

PARAGRAPH	PAGE
1.0 INTRODUCTION.....	1-1
1.1 PURPOSE	1-1
1.2 SCOPE	1-1
1.3 PRECEDENCE	1-1
2.0 DOCUMENTATION.....	2-1
2.1 APPLICABLE DOCUMENTS	2-1
3.0 PAYLOAD VERIFICATION	3-1
3.1 PAYLOAD VERIFICATION PROCESS OVERVIEW	3-1
3.1.1 PLANNING OVERVIEW	3-1
3.1.2 IMPLEMENTATION & REPORTING OVERVIEW	3-1
3.1.3 CERTIFICATION OVERVIEW	3-1
3.1.4 CERTIFICATION MAINTENANCE OVERVIEW.....	3-1
3.2 PAYLOAD VERIFICATION PLANNING DETAILS	3-3
3.2.1 UNIQUE PVP DEVELOPMENT	3-3
3.2.2 MODIFICATION OF VERIFICATION DEFINITION SHEETS (VDS)	3-3
3.2.3 CREATION OF UNIQUE VERIFICATION DEFINITION SHEETS.....	3-4
3.2.4 HUMAN-FACTORS RELATED VERIFICATION CLOSEOUT CONSIDERATION	3-4
3.2.5 CREW EVALUATION PLAN	3-5
3.2.6 THE VERIFICATION DEFINITION SHEET	3-5
3.2.6.1 VDS HEADER.....	3-7
3.2.6.2 VDS BODY.....	3-9
3.3 VERIFICATION SUBMITTAL PROCESS	3-12
4.0 CROSS-REFERENCE MATRICES	4-1

APPENDIX

A ABBREVIATIONS AND ACRONYMS.....	A-1
B VERIFICATION DEFINITION SHEETS	B-1
C EXAMPLE SUBMITTAL FORMS	C-1
D HUMAN FACTORS VDS CANDIDATE LIST NOT REQUIRING ANALYSIS FOR VERIFICATION	D-1
E MICROGRAVITY CONTROL PLAN	E-1
F ELECTROMAGNETIC INTERFERENCE/ ELECTROMAGNETIC COMPATIBILITY (EMI/EMC) CONTROL, TEST PLAN AND DESIGN ANALYSIS REPORT	F-1
G EMI/EMC TEST DATA FORMAT	G-1

TABLE OF CONTENTS (Concluded)

PARAGRAPH		PAGE
------------------	--	-------------

TABLES

3.2.2-1	VERIFICATION DEVIATION TABLE	3-4
4-1	INTERFACE REQUIREMENTS DOCUMENT (IRD) TRACEABILITY MATRIX	4-1
4-2	VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX	4-13

FIGURES

3.1-1	VERIFICATION PROCESS	3-2
3.2.6-1	EXAMPLE VERIFICATION DEFINITION SHEET	3-6

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to define the complete set of verification activities necessary to ensure compliance with the requirements identified in SSP 57003, Attached Payload Interface Requirements Document (IRD). Specific design constraints and resource allocations are contained in Unique Payload Hardware Interface Control Documents (ICD). Unique Payload Software ICDs define command and data interfaces for payloads to be verified per this document. This document provides instructions and guidelines for creating a Unique Payload Verification Plan (PVP), which is required by the Space Station Program. This document does not address all safety requirements. The Payload Developer (PD) must consult NSTS 1700.7 ISS Addendum to ensure compliance with both the generic and unique payload safety requirements.

1.2 SCOPE

This document encompasses the complete set of verification requirements that address interface compatibility of Attached Payloads during on-orbit integration and operations. All PDs that provide hardware or software that interface with ISS-provided equipment or flight crew on the Integrated Truss Assembly (ITA) will use this document to develop their Unique Payload Verification Plan. The verification of payload functional capabilities for achievement of science objectives and/or payload safety hazard controls are not within the scope of this document.

1.3 PRECEDENCE

Inconsistencies among ISS payload verification-related documentation will be resolved by giving precedence in the following top-down order:

- A. SSP 50011-1, ISS Concept of Operations and Utilization (COU), Volume I
- B. SSP 57011, ISS Payload Verification Program Plan
- C. SSP 57003, Attached Payloads Interface Requirements Document
- D. SSP 57013, Generic Attached Payload Verification Plan
- E. SSP 57200 Series Documents, Unique Payload Hardware ICDs
- F. SSP 57300 Series Documents, Unique Payload Software ICDs
- G. SSP 57400 Series Documents, Unique Payload Verification Plans
- H. SSP 57004, Attached Payloads Hardware ICD Template
- I. SSP 57002, Payload Software ICD Template

Information contained in the Applicable Documents (Section 2.1) may be repeated in this document. In case of conflict, the applicable document (revision and date specified) will take precedence.

2.0 DOCUMENTATION

The following documents include specifications, models, standards, guidelines, handbooks, and other special publications related to verification activities described herein. The current issue of each document is to be used during the development of the Unique Payload Hardware ICD. A specific document release date and revision level will be documented in the Unique PVP when the Unique ICD is placed under Payload Control Board control. The status of documents identified below may be determined from the International Space Station Program Baseline Activity Index and Status Report.

The documents below form a part of this plan to the extent described herein. In the event of a conflict between the documents referenced and the contents of this verification plan, the applicable document revision listed in the Unique ICD will take precedence. Any changes to the revision level of the applicable documents listed in the Unique ICD must be assessed for impact through the Change Request processes.

2.1 APPLICABLE DOCUMENTS

DOCUMENT NO.	TITLE
ANSI X3.255	Fiber Distributed Data Interface (FDDI)-Abstract Test Suite for FDDI Physical Medium Dependent Conformance Testing (PMDATS)
ASTM E595	Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment
ASTM E1559	Standard Test Method for Contamination Outgassing Characteristics of Spacecraft Materials
CCSDS 701.0-B-2	Advanced Orbiting Systems, Networks, and Data Links: Architectural Specifications
D684-10056-01	International Space Station Program, Prime Contractor Software Standards and Procedures Specification
FED-STD-595	Colors Used in Government Procurement
ISO/IEC 8802-3	ANSI/IEEE STD 802.3
MIL-HBK-1553	Multiplex Application Handbook
MIL-STD-461	Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility
MIL-STD-462	Measurement of Electromagnetic Interference Characteristics
MIL-STD-1553	Digital Time Division Command/Response Multiplex Data Bus

MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) Document
MS 33540	General Practices for Safety Wiring and Cotter Pinning
MSFC-STD-531	High Voltage Design Criteria
NASA-STD-5003	Fracture Control Requirements for Payloads Using the Space Shuttle
NSTS 1700.7 ISS Addendum	Safety Policy and Requirements for Payloads Using the ISS AddendumInternational Space Station
NSTS 21000-IDD-ISS	International Space Station Interface Definition Document
NSTS/ISS 18798	Interpretations of National Space Transportation System/International Space Station (NSTS/ISS) Payload Safety Requirements
SAE AS4536	Safety Cable Kit Procurement Specification and Requirements for Use
SN-C-0005	NSTS Contamination Control Requirements Manuel
SSP 30237	Space Station Requirements for Electromagnetic Emission and Susceptibility Requirements
SSP 30238	Space Station Electromagnetic Techniques
SSP 30240	Space Station Grounding Requirements
SSP 30242	Space Station Cable/Wire Design and Control Requirements for Electromagnetic Compatibility
SSP 30243	Space Station Requirements for Electromagnetic Compatibility
SSP 30245	Space Station Electrical Bonding Requirements
SSP 30256: 001	Extravehicular Activity Standard Interface Control Document
SSP 30312	Electrical, Electronic, and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program
SSP 30426	External Contamination Control Requirements
SSP 30482	Electrical Power Specifications and Standards
SSP 30550	Space Station Robotic System Integration Standards Vol 1 Robotic Accommodations Requirement
SSP 41162	Segment Specification for the USOS
SSP 41175-2	Software Interface Control Document Part 1 Station Management and Control to ISS Book 2, General Software Interface Requirements

SSP 42004	Mobile Servicing System to User (generic) Interface Control Document
SSP 50005	International Space Station Flight Crew Integration Standard (NASA-STD-3000/T) Document
SSP 50184	High Rate Data Link Physical Media, Physical Signaling & Protocol Specification
SSP 52005	Payload Flight Equipment Requirements and Guidelines for Safety Critical Structures
SSP 52050	Software Interface Control Document Part 1
SSP 52054	ISS Payload Certification of Flight Readiness Implementation Plan Generic
SSP 57000	Pressurized Payload Interface Requirements Document
SSP 57002	Payload Software Interface Control Document Template
SSP 57003	Attached Payload Interface Requirements Document
SSP 57004	Attached Payload Hardware Interface Control Document Template
SSP 572XX	Unique Payload Hardware ICD (Series Document)
SSP 573XX	Unique Payload Software ICD (Series Document)
SSQ 21654	Cable, Single Fiber, Multitude, Space Quality, General Specification for Document
SSQ 21655	Cable, Electrical, MIL-STD-1553 Data Bus, Space Quality, General Specification for Document
Tech. Memo 102179	Selection of Wires and Circuit Protection Devices for NSTS Orbiter Vehicle Payload Electrical Circuits

(This Page Intentionally Left Blank)

3.0 PAYLOAD VERIFICATION

3.1 PAYLOAD VERIFICATION PROCESS OVERVIEW

A payload verification process is comprised of four major activities, shown in Figure 3.1-1, Verification Process. These activities are planning, implementation and reporting, certification, and certification maintenance. Each PD is required to follow this process in order to achieve payload flight certification endorsement.

3.1.1 PLANNING OVERVIEW

A generic set of Verification Definition Sheet(s) (VDSs) (see Appendix B) provides instructions, definitions, references, and guidelines for the verification activities associated with each payload design requirement contained in the IRD. The VDS describes what steps should be taken by the PD to verify that the payload hardware and software has satisfied the specific IRD requirement. The collection of VDSs associated with the IRD in this Generic Attached Payload Verification Plan (GAPVP) forms the basis for generating the Unique PVP, which is tailored to the individual characteristics of each payload.

3.1.2 IMPLEMENTATION AND REPORTING OVERVIEW

The implementation and reporting phase is the PD's execution of the Unique PVP, which consists of performing the verification as defined in the VDSs contained in the Unique PVP. This phase also covers verification statusing and tracking; data deliverables and schedules; and support of ISS safety and integration reviews.

3.1.3 CERTIFICATION OVERVIEW

The certification process includes the signing by the PD of a statement indicating that all of the requirements and verifications of ISS compatibility, functionality and safety compliance are observed. Refer to SSP 52054, ISS Payloads Certification of Flight Readiness Implementation Plan Generic, for details of the Certification of Flight Readiness (CoFR) process.

3.1.4 CERTIFICATION MAINTENANCE OVERVIEW

Certification maintenance activities occur after signing the CoFR endorsement. Any change to the payload items that are required after the initial certification endorsement must be assessed to ensure that previous verification activity and certification endorsements are not invalidated. The changes shall be coordinated with the ISS Payload Program Office for concurrence regarding any required reverification.

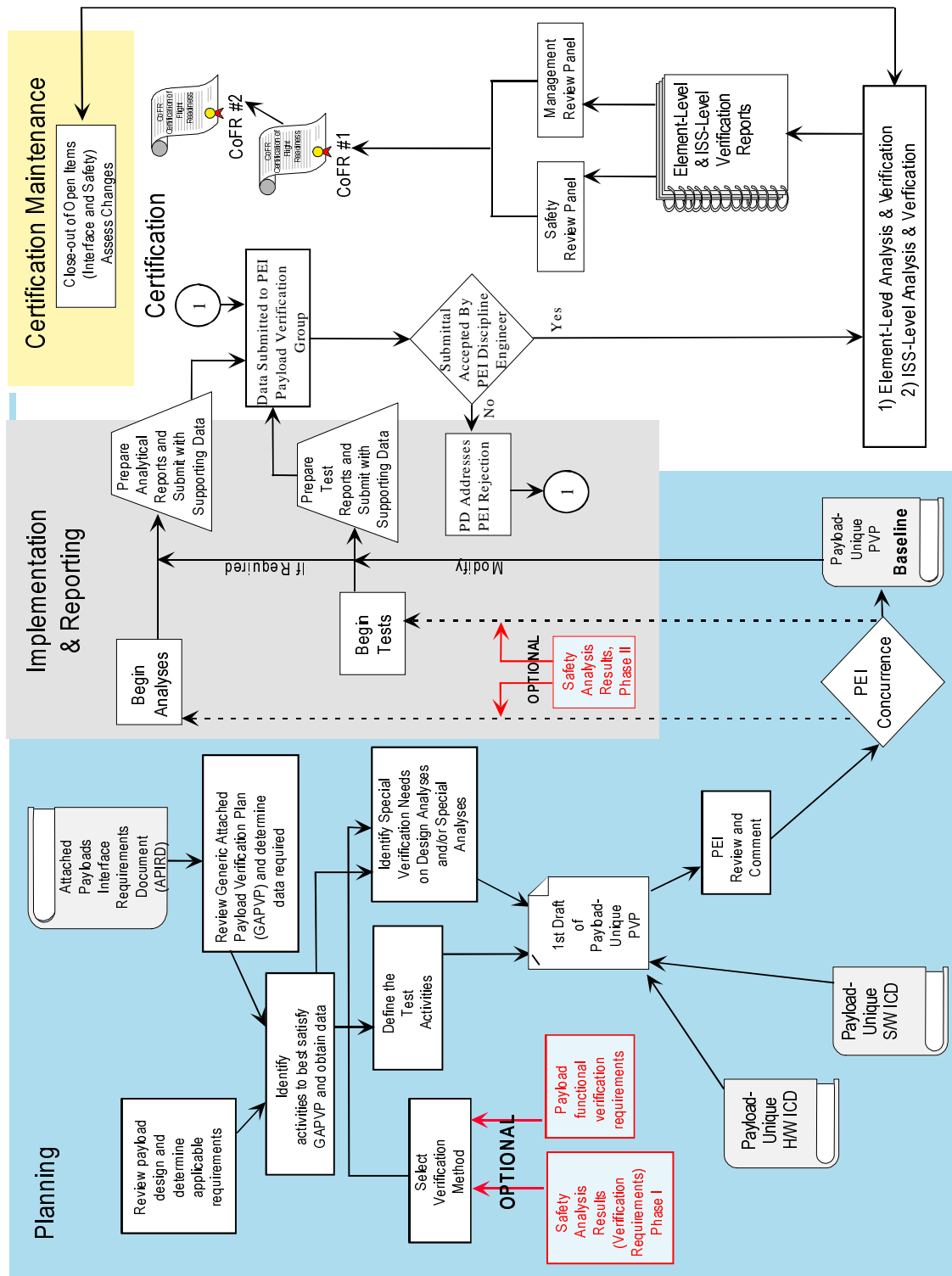


FIGURE 3.1-1 VERIFICATION PROCESS

3.2 PAYLOAD VERIFICATION PLANNING DETAILS

The planning process involves the review of the design to determine which requirements in SSP 57003, Section 4 and SSP 57013, Appendix B are applicable to each item of equipment and the identification and/or definition of the activities necessary to demonstrate that each applicable requirement has been met. The planning process can also include defining the functionality and safety verification requirements at the discretion of the PD in the Unique PVP. The following sections describe the process used to develop a Unique PVP.

3.2.1 UNIQUE PVP DEVELOPMENT

The first step in the development of the unique PVP is to establish a Unique Payload Hardware and Software Interface Control Document (ICD). The Unique PVP can be easily developed in parallel with the Unique Payload ICD (see Planning Phase of Figure 3.1-1). Payload safety and functionality (performance) requirements shall be incorporated along with the applicable VDSs from the GAPVP into the Unique PVP. For each applicable IRD requirement, there will be at least one VDS in the unique PVP that describes what is to be done to ensure that the payload hardware and software have met the specified requirement. Section 4 reflects the VDS-to-IRD requirement reference numbers in a matrix format. The VDSs are provided in Appendix B.

Other, existing project verification plans may be used as the Unique PVP if the content of the project verification plan meets the intent of this document. At a minimum, the project verification plan must contain a cross reference from its verification requirements to the GAPVP VDSs, a definition of the verification method for each requirement, a brief description of how each requirement will be verified, and the schedule for each verification activity. The Space Station Payloads Office will review the Project verification plan and the Payloads Office Control Board will control the requirements corresponding to the GAPVP VDSs.

3.2.2 MODIFICATION OF VDSs

The specific requirements given in the VDSs and the methods of verification have been extracted from the SSP 57003, Attached Payloads Interface Requirements Document. The due dates have been extracted from information in SSP 57011, Payload Verification Program Plan. Therefore, non-compliance with any of these items in the VDSs must be processed as an Exception, and documented in Table 3.2.2-1, Verification Deviation Table. After the Unique PVP is baselined, non-compliances must be handled through the waiver process as detailed in SSP 57004, Attached Payloads Interface Control Document.

If a project verification plan is used as the unique PVP, changes to the methods or submittal dates defined in the VDSs must also be processed as Exceptions and documented in a table in the project verification plan which meets the intent of Table 3.2.2-1.

The order of preference of verification is:

- Test
- Analysis

- Inspection
- Demonstration

Proposed changes to the verification method may be more easily approved if the proposed verification method is preferred over (i.e. more stringent than) the method named in the VDS. For example, testing may be done instead of analysis, inspection, or demonstration.

Table 3.2.2-1 VERIFICATION DEVIATION TABLE

VDS Number	VDS Title	Description of Deviation	Reason for Deviation
<i>Example ME-003</i>	<i>Payload In-flight Maintenance</i>	<i>Demonstration used in place of Analysis</i>	<i>Demonstration is easier and less costly than Analysis</i>
<i>Example EL-012</i>	<i>Remote Power Controllers</i>	<i>Submittal date at L-20 instead of L-22</i>	<i>Hardware will not be ready for testing at L-22</i>

3.2.3 CREATION OF UNIQUE VERIFICATION DEFINITION SHEETS

Decisions made during the development of the unique ICD may require creation of unique VDSs to accurately and completely reflect the verification required based on unique characteristics of an individual payload. A unique VDS (related to functionality or safety) will be created when no generic VDS exists that covers a special or unique requirement defined in the Attached Payload Hardware IRD, or when the generic VDS is in some way inadequate to verify a special aspect of the payload. Creation of unique VDSs requires coordination and concurrence between NASA Payload Office and Payload Developer.

3.2.4 HUMAN FACTORS RELATED VERIFICATION CLOSEOUT CONSIDERATION

For Human Factors requirements which must be verified by demonstration or test, it is important to involve the crew or designated representative (SVITO) during verification. The crewmember or designated representative will evaluate the PD-provided flight hardware to assess whether operational suitability is met. The results of these crew evaluations, when approved by the Chief of the Astronaut Office, will serve as data that may be used for closure of PD verification requirements. Crew evaluations for this purpose should be planned well in advance and contingency plans developed if the crew becomes unavailable to complete this activity. For the crewmember to perform these tasks, it is the PD's responsibility to negotiate and schedule with the Astronaut Office and SVITO at least four weeks prior to the verification activity.

3.2.5 CREW EVALUATION PLAN

Development Phase:

For hardware that interfaces with the crew and which requires crew evaluation during verification, the payload developer should involve the crewmember during the development phase of the hardware to ensure that the hardware is acceptable for safe and effective operation in the ISS. The crewmember approach will be to observe, utilize or operate, evaluate the functionality of the individual interface features, and recommend modifications as required. This will be accomplished in several stages, with early crewmember exposure to interface features during their development site visits.

Execution Phase:

For hardware that interfaces with the crew and which requires crew evaluation during verification, the PD-developed flight hardware will be made available during final installation for the crewmember to evaluate the operational suitability of these selected Human Factors interfaces. The process is for the Astronaut Office to be presented the procedure one month prior to the evaluation for approval. The procedure shall define the requirements and the description (picture/drawings) of the interface to be evaluated. The crewmember/team or designated representative will evaluate these interfaces and submit their results to the Johnson Space Center (JSC) Astronaut Office for concurrence. Once approval is obtained from the Astronaut Office, this evaluation will be used for closure of the verification of the requirement.

3.2.6 THE VERIFICATION DEFINITION SHEET

Figure 3.2.6-1, Example Verification Definition Sheet, is separated into two parts, the header and the body. Paragraph 3.2.6.1, VDS Header, explains blocks A through D of Figure 3.2.6-1, and paragraph 3.2.6.2, VDS Body, explains blocks E through O of Figure 3.2.6-1.

Ⓐ Number	Ⓑ Title Example VDS	Ⓒ Method A/D/I/T	Ⓓ Hazard Report(s) Unique PVP only
Ⓔ SSP 57003 Section 4 Number(s), Title(s), and Method(s): Applicable SSP 57003 Section 4.0 requirements.			
Ⓕ Requirement Summary: Brief summary of the requirement(s) that must be verified to ensure payload hardware/software interface compatibility.			
Ⓖ Detailed Descriptions of Requirements: Instructions and details suggesting how the verification method(s), as identified in the header, should be implemented (what analyses, test, inspections, or demonstrations are required and implementation details). In addition, any related clarification deemed necessary to further explain what is required will be provided.			
Ⓗ Required Verification Data: 1. Data that is required to be submitted showing compliance to the verification requirement.			Ⓘ Data Submittal Dates: 1. Date the data is to be submitted to the ISS. Usually shown as a Launch -X (e.g., L-6) in months
Ⓙ Description of Reverification Requirements: I. Description of the requirement that must be accomplished prior to on-orbit relocation of the payload. II. Description of the requirement that must be accomplished prior to on-orbit PL change out (new, re-flight, or series) of the Attached Payload		Ⓚ Reverification Method: A/D/I/T	Ⓛ Hazard Report(s): Unique PVP only
Ⓜ Required Reverification Data: I. Submittal data required for item I above. II. Submittal data required for item II above.			Ⓝ Data Submittal Dates: I. Date the data is to be submitted to the ISS. II. Date the data is to be submitted to the ISS.
Ⓞ Applicable Document(s): Listing of any documents that are applicable to the identified verification requirement.			

FIGURE 3.2.6-1 EXAMPLE VERIFICATION DEFINITION SHEET

3.2.6.1 VDS HEADER

The header is used for identification and tracking purposes and contains:

A. Number (Alphanumeric)

(1) (2)

AA- NNN

(1) Discipline Identifier [2 characters (alphabetical)]

ST	-	Structural
ME	-	Mechanical (include Human Factors)
EL	-	Electrical
CD	-	Command and Data Handling (C&DH) (Command & Data Handling and audio/video)
EN	-	Environmental
MP	-	Materials and Processes
TC	-	Thermal Control
SA	-	Safety (This category is for use by the PDs to address generic and unique safety requirements in their Unique PVPs.)
FN	-	Functionality (performance) Related (Requirements in this category are the responsibility of the PD as coordinated with Payload Integration Management)

Note: Requirements in Categories SA and FN are not within the scope of this plan but are included for completeness. They are the responsibility of the PD (with appropriate guidance from Payload Integration Management and Program safety engineers). They shall be incorporated into the unique PVP. Data submittals for any SA and FN VDSs are not required by ISS Payload Engineering and Integration.

(2) Numerical Sequence NNN [3 digits (numeric)]

Use all digits - 001, 002, etc. This number represents sequential numbering of VDSs driven by the discipline. Example: ST- 003. This is the third VDS within the structures discipline.

B. Title

The requirement title is a category identification of the design requirement and is derived from the IRD requirement paragraph title. If the verification requirement covers more than one IRD requirement, a general statement is provided.

C. Method

There are four unique methods of verifying a design requirement: Analysis (A), Test (T), Inspection (I), and Demonstration (D). Each VDS will identify the required method of verification by indicating the method letter identifier, or a combination of identifiers, if more than one method applies.

(1) Test

Test is actual operation of equipment, normally instrumented, under simulated or flight equivalent conditions or the subjection of parts or equipment to specified environments to measure and record responses in a quantitative manner. (Flight hardware will be required for all tests unless the use of hardware which replicates flight hardware is specifically identified on the VDS.)

(2) Analysis

Analysis is the technical evaluation process of using techniques and tools such as mathematical models and computer simulations, historical/design/test data, and other quantitative assessments to calculate characteristics and verify specification compliance. Analysis is used to verify requirements where established techniques are adequate to yield confidence or where testing is impractical.

(3) Inspection

Inspection is a physical measurement or visual evaluation of equipment and associated documentation. Inspection is used to verify construction features, drawing compliance, workmanship, and physical condition. (Flight hardware will be required for all inspections unless the use of hardware which replicates flight hardware is specifically identified on the VDS.)

Note: Inspection in this context does not imply a quality control type of activity.

(4) Demonstration

Demonstration is the qualitative determination of compliance with requirements by observation during actual operation or simulation under pre-planned conditions and guidelines. (Flight hardware will be required for all demonstrations unless the use of hardware which replicates flight hardware is specifically identified on the VDS.)

D. Hazard Report(s) (This block can be used in the unique PVP)

A payload Hazard Report identifies safety verification methods to ensure hazard controls will function/operate as intended. The PD is encouraged to identify the payload Hazard Report which includes safety verification method(s) that are the same as the verification activity(ies) described on the VDS. This allows traceability between payload verification and safety verification used to control hazards. If the VDS is not related to safety place Not Applicable (“N/A”) in the block.

3.2.6.2 VDS Body

The body of the VDS contains the following: a summary statement of the applicable design requirement, the verification method description, and tasks to be accomplished to verify that the requirement has been satisfied. It also contains a description of the data that must be generated and delivered as proof of meeting the requirement, and any applicable documentation and notes that may aid in accomplishing the verification.

E. IRD Section 4 Number(s), Title(s), and Method(s):

This section contains a listing of the SSP 57003, Section 4 Requirements that the VDS addresses.

F. Requirement Summary:

A summary statement of the intent of the IRD requirements that the VDS addresses.

G. Detailed Descriptions of Requirements:

This section includes instructions and details suggesting how the verification method(s) identified in the header should be implemented (what analyses, tests, inspections, or demonstrations are required and implementation details). In addition, any related clarification deemed necessary to further explain what is required will be provided.

H. Required Verification Data:

The results of verification activities shall be documented. All supporting documentation will be retained and provided by the PD upon request. Data that is required to be submitted will be identified on the VDS. Data submittals specified herein do not relieve the PD from reports required to support program and design reviews. The three categories of submittal data are defined below and the VDS will identify which category is acceptable to demonstrate compliance with the verification requirement.

(1) Certificate of Compliance

A Certificate of Compliance (COC) is a memorandum from a PD certifying that the hardware and/or software complies with the applicable VDS requirement. Multiple VDSs may be combined on a single COC. It should also state that the supporting data will be maintained by the PD and provided upon request. A COC can be used to address analysis, test, inspection, and demonstration verification methods. An example is given in Appendix C.

Note: For Command and Data Handling VDSs some of the COC submittals would follow the following process:

- At L-16 the PD would submit to the PEI Payload Verification Group a COC that stated that the data entered into the Payload Data Library (PDL) is complete and ready for flight. This is considered a “Private Level” PDL data submittal. Data requirements that should be part of the submittal consist of the following: 100% definition from the PD at the PDL for Payload Health & Status, Telemetry Packet Profiles, Telemetry Packet Definitions for HOSC processing (if needed), command definitions, limits, state codes, and calibration coefficient for command and telemetry parameters. As a minimum, the PD should provide calibration coefficients based on the vendor data specification sheets from the hardware design if actual calibration coefficients are not available.

A “Private Level” submittal to PDL is the level that a PD can enter data into the PDL. This is the lowest level or the working level in PDL. Once a PD completes their data entry, then they can promote their data inside PDL to the integration level.

At the “Integration Level” period the Payload Engineering and Integration (PEI) office has the responsibility to verify the validity of the Attached Payload data for ISS compliance. The PEI office also has the responsibility to enter ISS controlled/provided data required to complete the Payloads data sets. If PEI discovers any problems with the data, then PEI will demote the Payload data back down to the Private Level to have it corrected by the PD. Once corrected, a new COC will be signed and the PD should promote the data back to the integration level. The final process is for PEI to promote the Attached Payload data set to the Configuration Management Level for baselining.

At the “Configuration Managed Level” the Attached Payload data set is controlled at the ISS level and all changes must go through the CR process. In addition, the Attached Payload data set can be sent to the dependent databases for flight configurations and simulations.

- At L-11 the PD should submit a COC that states either that there are no changes since the L-16 delivery or if there are changes, state what they are. The data requirements that may be submitted would consist of the following: actual hardware calibration coefficients should be available, software definition changes due to test validations or simulations, and new software requirements. NOTE: The above PDL data input process for the PDs applies here as well.
- At L-8 the PD should submit a COC that states either that there are no changes since the L-11 delivery or if there are changes they are to state what they are. The data requirements that may be submitted would consist of the following: actual hardware calibration coefficients should be available, software definition changes due to test validations or simulations, and new software requirements. NOTE: These are flight

quality data definitions and no more changes are allowed after L-8. NOTE: The above PDL data input process for the PDs applies here as well.

- At L-6, on those C&DH VDSs that have “Test” as a verification method, the PD should submit a COC to the Space Station Payload Office to certify that the testing was performed with the PRCU, STEP, or equivalent after the data was verified by PSIV. NOTE: This is a general comment. Specific VDSs have been updated to include L-6 test COC data submittal requirements.

(2) Data Certification

A Data Certification is a memorandum from a PD certifying that the requirements identified on the referenced VDS have been met and providing the required summary results. It should also state that the supporting data will be maintained by the PD and provided upon request. The Data Certification will provide the following information:

- Statement of fact concerning the completion of the applicable analysis or test.
- Completion date of the analysis or test
- Identification of the report containing the results of the analysis or test (i.e., Title and Number).
- Summary statement including the results of the analysis or test (e.g., margins of safety summary table or an isolation measurement).

An example is given in Appendix C.

(3) Detailed Data

Detailed data submittals require the complete analysis or test report and not just a summary of the results. An example is given in Appendix C.

I. Data Submittal Dates:

This block contains the submittal dates for the required verification data. The submittal dates in this plan are in terms of launch minus a number of months, (i.e., L-6 would be launch minus six months).

J. Description of Reverification Requirements:

The reverification section of the VDS currently describes the two scenarios that may require additional verification activities to be performed by the PD. The activities could include a complete or partial rework of the analysis, demonstration, inspection, and test requirements that were originally needed to show compliance with the VDS. When the PD has defined any on-orbit payload component planned activities such as hardware modifications, component change out, or maintenance, reverification requirements will be established and included in the Unique PVP.

The details of the reverification requirement and the required submittal data are documented on each VDS in Appendix B. The two reverification conditions are listed below.

- (1) On-orbit relocation of the Attached Payload.
- (2) On-orbit Attached Payload change out (new, re-flight, or series).

When the statement “Same as the Detailed Descriptions of Requirements identified above” is listed in this section, it means that the analysis, demonstration, inspection, or test identified in the original requirement must be redone.

K. Reverification Method:

This block contains the method(s) used for reverification.

L. Hazard Reports (This block can be used in the unique PVP.)

Same as block D.

M. Required Reverification Data:

This section of the VDS identifies the data that must be submitted to show compliance with the reverification requirement. When the statement, “Same as the Required Verification Data identified above” appears in this section, new COCs, Data Certification, or detailed data must be submitted to show compliance with the reverification requirement.

N. Data Submittal Dates:

This block contains the submittal dates for the required reverification data. Any data submittals with a launch minus date must be submitted prior to any on-orbit operations of the payload.

O. Applicable Document(s):

This section of the VDS lists any documents that are applicable to the requirements listed on the VDS.

3.3 VERIFICATION SUBMITTAL PROCESS

The data submittals identified on the VDSs of the unique PVP shall be submitted as they become available, but no later than the agreed upon date listed in each unique PVP VDS. Example submittal forms are provided in Appendix C. PDs shall submit completed verification packages to the Payload Engineering Integration (PEI) Payload Verification Group. The applicable ICD engineer will notify the PD if the PEI Team rejects the data submittal or requests additional data. The ICD engineer will provide the PD a list of the additional data required to closeout the verification package. The PD shall submit the additional data required to the PEI Payload Verification Group per the required dates. Additionally,

PDs can monitor the verification tracking process through the web page (<http://iss-www.jsc.nasa.gov/ss/issapt/payofc/documents/PayloadsVerificationStatus.html>). Figure 3.1-1, Verification Process, contains the flow of the submittal process.

(This Page Intentionally Left Blank)

4.0 CROSS-REFERENCE MATRICES

This section contains Table 4-1, IRD Traceability Matrix, Table 4-2, VDS to IRD Section 4 cross-reference Matrix (the Safety Yes/No and Hazard Number columns are included in this table as aids in the construction of the Unique PVPs).

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.0	INTERFACE REQUIREMENTS	TITLE
3.1	Structural/Mechanical and Microgravity Interface Requirements	NVR
3.1.1	General Design Requirements	ME-004
3.1.1.1	SAFETY CRITICAL STRUCTURES	TITLE
3.1.1.1.1	Fail-Safe, Safe-Life, Or Low-Risk Fracture Parts	ST-006
3.1.1.1.2	Fracture Control	ST-006
3.1.1.1.3	Meteoroid and Orbital Debris Protection Requirement for External Payloads	ST-010
3.1.1.2	Interface Loads	NVR
3.1.1.2.1	Margins of Safety	ST-002
3.1.1.2.2	Factor(s) of Safety	ST-001
3.1.1.2.3.A	Design Loads	ST-001
3.1.1.2.3.B	Design Loads	ST-001
3.1.1.2.4	Payload Berthing	ST-001
3.1.1.2.5	Thermal Effects	ST-001
3.1.1.2.6	Extravehicular Activity On-Orbit Induced loads	ST-002
3.1.1.3	Design Service Life	ST-003
3.1.1.4	Operational Lifetime	NVR
3.1.1.5	Interchangeability	ME-036
3.1.1.6	Attached Payload Interface Durability	ST-003
3.1.1.7.A	Structural Materials Criteria and Selection	ST-011
3.1.1.7.B	Structural Materials Criteria and Selection	ST-011
3.1.1.8	Structural Degradation from Material Erosion	ST-011
3.1.2	Structural/Mechanical Interface With The Mobile Servicing System	NVR
3.1.2.1	Structural Design Interface	ST-008
3.1.2.2	Mechanical Design Interface	ME-046
3.1.2.3.A	Mass and Envelope Dimensions	ME-001
3.1.2.3.B	Mass and Envelope Dimensions	ME-009
3.1.3	Structural/Mechanical Interface with the Integrated Truss Segment S3 Payload Attach System and Integrated Truss Segment P3 Unpressurized Cargo Carrier Attach System	NVR
3.1.3.1	STRUCTURAL/MECHANICAL	TITLE
3.1.3.1.1	PHYSICAL ENVELOPE REQUIREMENTS	TITLE
3.1.3.1.1.1	Payload Attach System/Unpressurized Logistics Carrier Attach System On-Orbit Operational Envelope	ME-006
3.1.3.1.1.2	Interface Plane Protrusion	ME-010

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.1.3.1.1.3.A	Extravehicular Activity/Robotics Operational Envelope	ME-006
3.1.3.1.1.3.B	Extravehicular Activity/Robotics Operational Envelope	ME-006
3.1.3.1.2	MASS PROPERTIES AND CENTER OF GRAVITY	TITLE
3.1.3.1.2.1	Payload Attach System Coordinate System Origin Location	ME-046
3.1.3.1.2.2	Mass & Center of Gravity	ME-001
3.1.3.1.3	Attached Payload Fundamental Frequency	ST-004
3.1.3.1.3.1	Interface Preload	ST-009
3.1.3.1.3.2	Interface Stiffness	ST-007
3.1.3.2	Mechanical Interface	NVR
3.1.3.2.1.A	Extravehicular Activity Releasable Capture Bar	ME-042
3.1.3.2.1.B	Extravehicular Activity Releasable Capture Bar	ME-042
3.1.3.2.2.A	Guide Pins	ME-020
3.1.3.2.2.B	Guide Pins	ME-020
3.1.3.2.3.A	Passive Umbilical Mechanism Assembly	ME-017
3.1.3.2.3.B	Passive Umbilical Mechanism Assembly	ME-013
3.1.3.2.3.C	Passive Umbilical Mechanism Assembly	ME-047
3.1.3.2.3.1.A	UMA Mounting	ST-008
3.1.3.2.3.1.B	UMA Mounting	ST-001
3.1.3.2.4.A	Mechanical Stop Design	ME-002
3.1.3.2.4.B	Mechanical Stop Design	ME-002
3.1.3.2.5	Safety Interlocks	ME-029
3.1.3.2.6	Microgravity	EN-003
3.1.3.2.6.1	Limit Quasi-Steady Accelerations	EN-003
3.1.3.2.6.2	Limit Vibratory and Transient Accelerations	EN-003
3.1.4	INTERFACE WITH SPACE STATION EXTRAVEHICULAR ROBOTICS	TITLE
3.1.4.1	Interface with NSTS Remote Manipulator System and Space Station Remote Manipulator System	ME-016
3.1.4.1.1	Grapple Fixture Locations	ME-015
3.1.4.1.2	Grapple Fixture Structural Support	ME-015
3.1.4.2	Interface with Special Purpose Dexterous Manipulator	ME-044
3.1.4.2.1.A	Special Purpose Dexterous Manipulator Fixture Locations	ME-054
3.1.4.2.1.B	Special Purpose Dexterous Manipulator Fixture Locations	ME-054
3.1.4.2.2	Special Purpose Dexterous Manipulator Fixture Structural Support	ME-054
3.2	ELECTRICAL INTERFACE REQUIREMENTS	TITLE
3.2.1	Electrical Interface with Mobile Servicing System MCAS	EL-026
3.2.2	Electrical Power Interface With The Integrated Truss Segment S3 Payload Attach System and P3 Unpressurized Cargo Carrier Attach System	NVR
3.2.2.1	Electrical Power Characteristics	NVR
3.2.2.1.1	Steady-State Voltage Characteristics	EL-001
3.2.2.1.2	Ripple Voltage Characteristics	TITLE
3.2.2.1.2.1	Ripple Voltage and Noise	EL-002
3.2.2.1.2.2	Ripple Voltage Spectrum	EL-002
3.2.2.1.3	TRANSIENT VOLTAGES	TITLE

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.2.2.1.3.1	Normal Transient Voltages	EL-003
3.2.2.1.3.2	Fault Clearing and Protection	EL-004
3.2.2.1.3.3.A	Interface C Non-Normal Voltage Range	EL-005
3.2.2.1.3.3.B	Interface C Non-Normal Voltage Range	EL-005
3.2.2.2	ELECTRICAL POWER INTERFACE	TITLE
3.2.2.2.1.A	Attached Payload Connectors and Pin Assignments	EL-006
3.2.2.2.1.B	Attached Payload Connectors and Pin Assignments	EL-006
3.2.2.2.2.A	Power Bus Isolation	EL-007
3.2.2.2.2.B	Power Bus Isolation	EL-007
3.2.2.2.3	Compatibility with Soft Start/Stop Remote Power Controller (RPC)	EL-008
3.2.2.2.4.A	Surge Current	EL-009
3.2.2.2.4.B	Surge Current	EL-009
3.2.2.2.5	Reverse Energy/Current	EL-010
3.2.2.2.6	CIRCUIT PROTECTION DEVICES	TITLE
3.2.2.2.6.1.A	International Space Station Electrical Power System Circuit Protection Characteristics	EL-023
3.2.2.2.6.1.B	International Space Station Electrical Power System Circuit Protection Characteristics	EL-023
3.2.2.2.6.2	Attached Payload Trip Ratings	EL-023
3.2.2.2.7	Interface C Attached Payload Complex Load Impedances	EL-025
3.2.2.2.8	Large Signal Stability	EL-012
3.2.2.3	ELECTRICAL POWER CONSUMER CONSTRAINTS	TITLE
3.2.2.3.1	Wire Derating	EL-013
3.2.2.3.2	Exclusive Power Feeds	EL-014
3.2.2.3.3	Loss of Power	EL-024
3.2.2.4	Electromagnetic Compatibility	EL-015
3.2.2.4.1	Electrical Grounding	EL-016
3.2.2.4.2	Electrical Bonding	EL-017
3.2.2.4.3	Cable/Wire Design and Control Requirements	EL-016
3.2.2.4.4	Electromagnetic Interference	EL-015
3.2.2.4.5.A	Electrostatic Discharge	NVR
3.2.2.4.5.B	Electrostatic Discharge	EL-018
3.2.2.4.6	Alternating Current Magnetic Fields	EL-015
3.2.2.4.7	Direct Current Magnetic Fields	EL-015
3.2.2.4.8	Corona	EL-018
3.2.2.4.9	Electromagnetic Interference Susceptibility For Safety-Critical Circuits	EL-015
3.2.2.5	SAFETY REQUIREMENTS	TITLE
3.2.2.5.1	Payload Electrical Safety	EL-022
3.2.2.5.1.1	Mating/Demating of Power Connectors	ME-017
3.2.2.5.1.2	Safety-Critical Circuits Redundancy	EL-022
3.2.2.5.2A	Power Switches/Controls	EL-020
3.2.2.5.2B	Power Switches/Controls	EL-020
3.2.2.5.2C	Power Switches/Controls	EL-020
3.3	Command and Data Handling Interface Requirements	NVR

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.3.1	Command and Data Handling Interface With Mobile Servicing System	CD-013
3.3.2	Command and Data Handling Interface With The Integrated Truss Segment S3 Payload Attach System and P3 Unpressurized Cargo Carrier Attach System	NVR
3.3.2.1	Word/Byte Notations, Types, and Data Transmissions	NVR
3.3.2.1.1	Word/Byte Notations	CD-001
3.3.2.1.2	Data Types	CD-001
3.3.2.1.3.A	Data Transmissions	CD-001
3.3.2.1.3.B	Data Transmissions	CD-001
3.3.2.2	Consultative Committee for Space Data Systems	NVR
3.3.2.2.1.A	Consultative Committee for Space Data Systems Data	CD-001
3.3.2.2.1.B	Consultative Committee for Space Data Systems Data	CD-001
3.3.2.2.1.1	Consultative Committee for Space Data Systems Data Packets	CD-001
3.3.2.2.1.1.1	Consultative Committee for Space Data Systems Primary Header	CD-001
3.3.2.2.1.1.2.A	Consultative Committee for Space Data Systems Secondary Header	CD-001
3.3.2.2.1.1.2.B	Consultative Committee for Space Data Systems Secondary Header	CD-001
3.3.2.2.1.2	Consultative Committee for Space Data Systems Data Field	CD-002
3.3.2.2.1.3	Consultative Committee for Space Data Systems Application Process Identification Field	NVR
3.3.2.2.2	CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS TIME CODES	TITLE
3.3.2.2.2.1	Consultative Committee for Space Data Systems Unsegmented Time	CD-003
3.3.2.2.2.2	Consultative Committee for Space Data Systems Segmented Time	NVR
3.3.2.3.A	MIL-STD-1553B Low Rate Data Link	CD-004
3.3.2.3.B	MIL-STD-1553B Low Rate Data Link	CD-004
3.3.2.3.1	MIL-STD-1553B Protocol	CD-004
3.3.2.3.1.1.A	Standard Messages	CD-004
3.3.2.3.1.1.B	Standard Messages	CD-004
3.3.2.3.1.2.A	Commanding	CD-004
3.3.2.3.1.2.B	Commanding	CD-004
3.3.2.3.1.3.A	Health and Status Data	CD-004
3.3.2.3.1.3.B	Health and Status Data	CD-004
3.3.2.3.1.3.C	Health and Status Data	CD-004
3.3.2.3.1.4.A	Safety Data	CD-004
3.3.2.3.1.4.B	Safety Data	CD-004
3.3.2.3.1.4.1	Caution and Warning	NVR
3.3.2.3.1.4.1.1	Class 1-Emergency	NVR
3.3.2.3.1.4.1.2.A	Class 2-Warning	CD-004
3.3.2.3.1.4.1.2.B	Class 2-Warning	CD-004
3.3.2.3.1.4.1.3.A	Class 3-Caution	CD-004

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.3.2.3.1.4.1.3.B	Class 3-Caution	CD-004
3.3.2.3.1.4.1.4.A	Class 4-Advisory	CD-004
3.3.2.3.1.4.1.4.B	Class 4-Advisory	CD-004
3.3.2.3.1.5	Service Requests	CD-005
3.3.2.3.1.6	Ancillary Data	CD-005
3.3.2.3.1.7	File Transfer	CD-005
3.3.2.3.1.8	Low Rate Telemetry	CD-005
3.3.2.3.1.9	Defined Mode Codes	NVR
3.3.2.3.1.10	Implemented Mode Codes	CD-006
3.3.2.3.1.11	Illegal Commands	CD-007
3.3.2.3.2	MIL-STD-1553B LRDL INTERFACE CHARACTERISTICS	TITLE
3.3.2.3.2.1	LRDL Connector/Pin Assignments	CD-009
3.3.2.3.2.2A	LRDL Signal Characteristics	CD-008
3.3.2.3.2.2B	LRDL Signal Characteristics	CD-008
3.3.2.3.2.3.A	LRDL Cabling	EL-021
3.3.2.3.2.3.B	LRDL Cabling	EL-021
3.3.2.4	HIGH RATE DATA LINK	TITLE
3.3.2.4.1	Payload to High Rate Frame Multiplexer Protocols	CD-010
3.3.2.4.2	High Rate Data Link Interface Characteristics	TITLE
3.3.2.4.2.1	Physical Signaling	CD-010
3.3.2.4.2.2	Encoding	CD-010
3.3.2.4.2.3	Symbols Used In Testing	CD-010
3.3.2.4.3	HIGH RATE DATA LINK OPTICAL POWER	TITLE
3.3.2.4.3.1	High Rate Data Link Transmitted Optical Power	CD-011
3.3.2.4.3.2	High Rate Data Link Received Optical Power	CD-011
3.3.2.4.4	High Rate Data Link Fiber Optic Cable	EL-019
3.3.2.4.5	High Rate Data Link Fiber Optic Cable Bend Radius	ME-005
3.3.2.4.6	High Rate Data Link Connectors	EL-011
3.3.2.4.7	High Rate Data Link Connector/Pin Assignments	EL-006
3.3.2.5	Portable Computer System	CD-012
3.4	PASSIVE THERMAL CONTROL INTERFACES	TITLE
3.4.1	PASSIVE THERMAL CONTROL INTERFACE WITH THE INTEGRATED TRUSS SEGMENT S3 PAYLOAD ATTACH SYSTEM AND INTEGRATED TRUSS SEGMENT P3 UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM	TITLE
3.4.1.1	Passive Thermal Control Design Requirements For Payload On Integrated Truss Segment S3 Payload Attach System and P3 Unpressurized Cargo Carrier Attach System	TC-003
3.4.1.1.1	Temperature Requirement	TC-003
3.4.1.1.2	Thermal Shadowing Envelope	NVR
3.4.1.1.3	Incident Solar Energy	TC-003
3.4.1.1.4	Heat Radiation	TC-004
3.5	ENVIRONMENT INTERFACE REQUIREMENTS	TITLE
3.5.1	ENVIRONMENT CONTROL INTERFACE WITH THE INTEGRATED TRUSS SEGMENT S3	TITLE

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
	PAYLOAD ATTACH SYSTEM AND S3 UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM	
3.5.1.1	Pressure	NVR
3.5.1.2	Thermal Environment	NVR
3.5.1.3	Humidity	NVR
3.5.1.4.A	Atomic Oxygen	NVR
3.5.1.4.B	Atomic Oxygen	NVR
3.5.1.5	External Contamination Requirements	NVR
3.5.1.5.1	Molecular Column Density from Venting, Leakage and Outgassing	EN-001
3.5.1.5.2.A	Molecular Deposition from Materials Outgassing and Venting	EN-001
3.5.1.5.2.B	Molecular Deposition from Materials Outgassing and Venting	EN-001
3.5.1.6	Electromagnetic Radiation	NVR
3.5.1.7	Plasma	NVR
3.5.1.8	IONIZING RADIATION	TITLE
3.5.1.8.1	Attached Payload Contained or Generated Ionizing Radiation	EN-002
3.5.1.8.2	Ionizing Radiation Dose	EN-002
3.5.1.8.3	Nominal Single Event Effects Ionizing Radiation	EN-002
3.5.1.8.4	Extreme Single Event Effects	EN-002
3.5.1.9	Solar Ultraviolet Radiation	NVR
3.5.1.10	Plume Impingement	NVR
3.5.1.11	Meteoroid and Orbital Debris	NVR
3.5.1.12A	Acceleration Environment	ST-001
3.5.1.12B	Acceleration Environment	ST-001
3.5.1.13	Vibration Environment	ST-001
3.6	MATERIALS AND PARTS INTERFACE REQUIREMENTS	TITLE
3.6.1	Materials and Parts Use and Selection	ST-011
3.6.1.1	Thermal Coating	MP-003
3.6.2	Commercial Parts	MP-002
3.6.3	Cleanliness	MP-001
3.7	EXTRAVEHICULAR ROBOTIC REQUIREMENTS	TITLE
3.7.1.A	Equipment Requiring Shuttle Robotic Support	NVR
3.7.1.B	Equipment Requiring Shuttle Robotic Support	ME-012
3.7.1.C	Equipment Requiring Shuttle Robotic Support	ME-015
3.7.1.D	Equipment Requiring Shuttle Robotic Support	ME-015
3.7.1.E	Equipment Requiring Shuttle Robotic Support	ME-001
3.7.1.F	Equipment Requiring Shuttle Robotic Support	NVR
3.7.1.G	Equipment Requiring Shuttle Robotic Support	ST-004
3.7.1.H	Equipment Requiring Shuttle Robotic Support	EL-027
3.7.1.I	Equipment Requiring Shuttle Robotic Support	TC-002
3.7.1.J	Equipment Requiring Shuttle Robotic Support	ME-014
3.7.1.K	Equipment Requiring Shuttle Robotic Support	ME-053
3.7.1.L	Equipment Requiring Shuttle Robotic Support	NVR

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.7.1.M	Equipment Requiring Shuttle Robotic Support	ST-008
3.7.1.N	Equipment Requiring Shuttle Robotic Support	ME-023
3.7.2	External Equipment Requiring Robotic Hand-Off	ME-051
3.7.3.A	External Equipment Requiring Space Station Remote Manipulator System Support	ME-046
3.7.3.B	External Equipment Requiring Space Station Remote Manipulator System Support	ST-004
3.7.3.C	External Equipment Requiring Space Station Remote Manipulator System Support	NVR
3.7.3.D	External Equipment Requiring Space Station Remote Manipulator System Support	ME-021
3.7.3.E	External Equipment Requiring Space Station Remote Manipulator System Support	ME-023
3.7.3.F	External Equipment Requiring Space Station Remote Manipulator System Support	ME-014
3.7.3.G	External Equipment Requiring Space Station Remote Manipulator System Support	ME-009
3.7.3.H	External Equipment Requiring Space Station Remote Manipulator System Support	NVR
3.7.3.I	External Equipment Requiring Space Station Remote Manipulator System Support	ME-045
3.7.3.J	External Equipment Requiring Space Station Remote Manipulator System Support	ST-008
3.7.3.K	External Equipment Requiring Space Station Remote Manipulator System Support	ME-046 and ME-015
3.7.3.1.A	Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture	ME-009
3.7.3.1.B	Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture	ME-046
3.7.3.1.C	Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture	NVR
3.7.3.1.D	Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture	NVR
3.7.3.1.E	Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture	ST-004
3.7.3.1.F	Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture	TC-002
3.7.3.1.G	Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture	EL-027
3.7.3.2.A	Equipment Requiring SSRMS Support Using Power Data Grapple Fixture	ME-009
3.7.3.2.B	Equipment Requiring SSRMS Support Using Power Data Grapple Fixture	ST-008
3.7.3.2.C	Equipment Requiring SSRMS Support Using Power Data Grapple Fixture	EL-004,027
3.7.3.2.D	Equipment Requiring SSRMS Support Using Power Data Grapple Fixture	EL-001, 002,003,004,005
3.7.3.2.E	Equipment Requiring SSRMS Support Using Power Data	CD-014

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
	Grapple Fixture	
3.7.3.2.F	Equipment Requiring SSRMS Support Using Power Data Grapple Fixture	CD-014
3.7.3.2.G	Equipment Requiring SSRMS Support Using Power Data Grapple Fixture	ME-018
3.7.3.2.H	Equipment Requiring SSRMS Support Using Power Data Grapple Fixture	TC-002
3.7.3.2.I	Equipment Requiring SSRMS Support Using Power Data Grapple Fixture	EL-015
3.7.4.A	External Equipment Requiring Dexterous Robotic Support	ME-021
3.7.4.B	External Equipment Requiring Dexterous Robotic Support	ME-001, ST-004, ME-009
3.7.4.C	External Equipment Requiring Dexterous Robotic Support	ME-046
3.7.4.D	External Equipment Requiring Dexterous Robotic Support	ST-001, ST-004, ME-045
3.7.4.E	External Equipment Requiring Dexterous Robotic Support	ME-021
3.7.5.A	Equipment Requiring Robotic Translation	ME-001, ST-004, ME-009
3.7.5.B	Equipment Requiring Robotic Translation	ME-044
3.7.5.C	Equipment Requiring Robotic Translation	ME-044
3.7.5.D	Equipment Requiring Robotic Translation	ME-044
3.7.6	Berthing Camera System	ME-045
3.8.A	Extravehicular Activity	ME-047
3.8.B	Extravehicular Activity	ME-048
3.8.1.A	Extravehicular Activity as a Backup for Robotics Activities	ME-047
3.8.1.B	Extravehicular Activity as a Backup for Robotics Activities	ME-047
3.8.1.C	Extravehicular Activity as a Backup for Robotics Activities	ME-047
3.8.2	Extravehicular Activity Translation	ME-047
3.8.2.1	Payload Attach System/Unpressurized Cargo Carrier Attach System Interface Clearances	ME-038
3.8.2.2	Extravehicular Activity Translation Corridor Protrusion	ME-021
3.8.3	HUMAN ENGINEERING DESIGN	TITLE
3.8.3.1	Crew Access Dimensions	ME-038
3.8.3.1.1	Body Envelope and Reach Accessibility	ME-038
3.8.3.1.1.1.A	Centering	ME-013
3.8.3.1.1.1.B	Centering	ME-013
3.8.3.1.1.2	Extravehicular Activity Crewmember Field of View	ME-049
3.8.3.1.1.3	External Task Location Requirements	ME-038
3.8.3.2	STRENGTH REQUIREMENTS	TITLE
3.8.3.2.1	External Limit Loads	ST-002
3.8.3.2.2	Extravehicular Activity Actuated Controls	ME-008
3.8.3.3	Mobility Aids and Restraints	ME-032

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.8.3.3.1	Provide Extravehicular Activity Handles	ME-034
3.8.3.3.1.1.A	Extravehicular Activity Handholds/Handrails	ME-034
3.8.3.3.1.1.B	Extravehicular Activity Handholds/Handrails	ME-034
3.8.3.3.1.2	Dimensions	ME-034
3.8.3.3.1.3.A	Mounted Clearance	ME-034
3.8.3.3.1.3.B	Mounted Clearance	ME-021
3.8.3.3.1.3.C	Mounted Clearance	ME-034
3.8.3.3.1.4.A	Positioning/Location	ME-038
3.8.3.3.1.4.B	Positioning/Location	ME-034
3.8.3.3.1.4.C	Positioning/Location	ME-035
3.8.3.3.1.5.A	Non-Fixed Handles Design	ME-002
3.8.3.3.1.5.B	Non-Fixed Handles Design	ME-028
3.8.3.3.1.5.C	Non-Fixed Handles Design	ME-030
3.8.3.3.1.6	Handrails/Handhold Tether Attachment	ME-032
3.8.3.3.1.7	Danger Warnings	ME-037
3.8.3.3.1.8	Color	ME-043
3.8.3.3.2	Extravehicular Activity Safety Tethers and Safety Hooks	ME-032
3.8.3.3.2.1.A	Tether Attachment Points	ME-031
3.8.3.3.2.1.B	Tether Attachment Points	ME-031
3.8.3.3.2.1.C	Tether Attachment Points	ME-031
3.8.3.4	GLOVED OPERATION	TITLE
3.8.3.4.1	Extravehicular Activity Gloved Hand Access	ME-038
3.8.3.5	Location Coding	ME-037
3.8.4	HUMAN ENGINEERING SAFETY	TITLE
3.8.4.1	EXTERNAL TOUCH TEMPERATURE	TITLE
3.8.4.1.1	Incidental Contact	TC-001
3.8.4.1.2	Unlimited Contact	TC-001
3.8.4.2	Equipment Clearance for Entrapment Hazards	ME-021
3.8.4.2.1	EXTERNAL CORNER AND EDGE PROTECTION	TITLE
3.8.4.2.1.1	Sharp Edges	ME-048
3.8.4.2.1.1.1.A	Exposed Edge Requirements	ME-048
3.8.4.2.1.1.1.B	Exposed Edge Requirements	ME-048
3.8.4.2.1.1.1.C	Exposed Edge Requirements	ME-048
3.8.4.2.1.1.1.D	Exposed Edge Requirements	ME-048
3.8.4.2.1.1.2.A	Exposed Corner Requirements	ME-048
3.8.4.2.1.1.2.B	Exposed Corner Requirements	ME-048
3.8.4.2.1.2	Thin Materials	ME-048
3.8.4.2.2	Burrs	ME-048
3.8.4.2.3	Holes	ME-007
3.8.4.2.3.1	Handrails/Holds	ME-007
3.8.4.2.4	Pinch Points	ME-007
3.8.4.2.5	Protective Covers for Portable Equipment	ME-007
3.8.4.2.6	LATCHES	TITLE
3.8.4.2.6.1.A	Design	ME-026
3.8.4.2.6.1.B	Design	ME-026
3.8.4.2.6.1.C	Design	ME-026
3.8.4.2.6.1.D	Design	ME-026

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.8.4.2.6.1.E	Design	ME-026
3.8.4.2.6.2	Protective Covers or Guards	ME-007
3.8.4.2.7	Captive Parts	ME-032
3.8.4.2.7.1	Screws and Bolts	ME-025
3.8.4.2.7.2	Securing Pins	ME-025
3.8.4.2.7.3	Locking Wires	ME-032
3.8.4.2.8	Safety Critical Fasteners	ME-025
3.8.4.2.9	Levers, Cranks, Hooks and Controls	ME-008
3.8.4.3	Moving or Rotating Equipment	ME-053
3.8.4.4	Power Sources	EN-002
3.8.4.5	Transmitters	ME-050
3.9	MAINTAINABILITY AND MAINTENANCE	TITLE
3.9.1	Qualitative Maintainability Design	NVR
3.9.1.1	FAILURE DETECTION, ISOLATION, AND RECOVERY	TITLE
3.9.1.1.1.A	Manual Failure Detection, Isolation, and Recovery	ME-041
3.9.1.1.1.B	Manual Failure Detection, Isolation, and Recovery	ME-039
3.9.1.1.1.C	Manual Failure Detection, Isolation, and Recovery	ME-040
3.9.1.1.1.D	Manual Failure Detection, Isolation, and Recovery	ME-003
3.9.1.1.1.E	Manual Failure Detection, Isolation, and Recovery	ME-008
3.9.1.2	Mean Maintenance Crew Hour Per Year	ME-003
3.9.1.3.A	Access	ME-038
3.9.1.3.B	Access	ME-038
3.9.1.3.C	Access	ME-038
3.9.1.3.D	Access	ME-038
3.9.1.4.A	Nonpressurized Area Equipment Maintenance Time	ME-003
3.9.1.4.B	Nonpressurized Area Equipment Maintenance Time	ME-003
3.9.1.5	Access Item Retainment	ME-032
3.9.1.5.1	Captive Parts	ME-033
3.9.1.6	INSTALLATION/REMOVAL	TITLE
3.9.1.6.1	Method	ME-028
3.9.1.6.2	Equipment Item Interconnecting Devices	ME-038
3.9.1.6.3	Incorrect Equipment Installation	ME-011
3.9.1.6.4	Lockwiring and Staking	ME-042
3.9.1.6.5.A	Restraining and Handling Devices for Temporary Storage	ME-042
3.9.1.6.5.B	Restraining and Handling Devices for Temporary Storage	ME-042
3.9.1.6.6	Installation/Removal Force	ST-005
3.9.1.6.6.1	Direction of Removal	ME-013
3.9.1.6.6.2	Visibility	ME-013
3.9.1.6.6.3.A	Mounting Alignment	ME-020
3.9.1.6.6.3.B	Mounting Alignment	ME-020
3.9.1.6.6.3.C	Mounting Alignment	ME-020
3.9.1.6.7	ORBITAL REPLACEMENT UNIT	TITLE
3.9.1.6.7.1	Capture Latch Assembly and Umbilical Mechanical Assembly EVA Override	ME-038
3.9.1.6.7.2	Payload Attach System and Unpressurized Cargo Carrier Attach System Orbital Replacement Unit Extravehicular	ME-038

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
	Activity Maintenance	
3.9.1.6.7.3	Attached Payload Remove/Replace Items	ME-003
3.9.1.7.A	Standard Extravehicular Activity/Extravehicular Robotics Interfaces	ME-047
3.9.1.7.B	Standard Extravehicular Activity/Extravehicular Robotics Interfaces	ME-045
3.9.1.7.1	Extravehicular Activity Tools	ME-016
3.9.1.7.1.1.A	Tool Clearance	ME-024
3.9.1.7.1.1.B	Tool Clearance	ME-024
3.9.1.7.1.1.C	Tool Clearance	ME-024
3.9.1.7.2.A	Payload Hardware and Equipment Mounting	ME-020
3.9.1.7.2.B	Payload Hardware and Equipment Mounting	ME-020
3.9.1.7.3	Connectors	ME-017
3.9.1.7.3.1.A	One-Handed Operation	ME-017
3.9.1.7.3.1.B	One-Handed Operation	ME-018
3.9.1.7.3.2.A	Mate/Demate	ME-017
3.9.1.7.3.2.B	Mate/Demate	ME-019
3.9.1.7.3.3.A	Connector Arrangement	ME-018
3.9.1.7.3.3.B	Connector Arrangement	ME-018
3.9.1.7.3.3.1	Status	ME-023
3.9.1.7.3.4	Connector Protection	ME-019
3.9.1.7.3.4.1	Protecting Caps	ME-032
3.9.1.7.3.5.A	Coding	ME-020
3.9.1.7.3.5.B	Coding	ME-020
3.9.1.7.3.6	Pin Identification	ME-037
3.9.1.7.3.7	Orientation	ME-020
3.9.1.7.3.7.1.A	Spacing	ME-018
3.9.1.7.3.7.1.B	Spacing	ME-018
3.9.1.7.4.A	Cable Restraints	ME-022
3.9.1.7.4.B	Cable Restraints	ME-022
3.9.1.7.4.C	Cable Restraints	ME-022
3.9.1.7.4.D	Cable Restraints	ME-022
3.9.1.7.5.A	Covers	ME-007
3.9.1.7.5.B	Covers	ME-003
3.9.1.7.5.C	Covers	ME-023
3.9.1.7.5.D	Covers	ST-002
3.9.1.7.5.E	Covers	ME-038
3.9.1.7.5.F	Covers	ME-032
3.9.1.7.5.G	Covers	ME-007
3.9.1.7.5.H	Covers	ME-007
3.9.1.7.6	Fasteners	ME-025
3.9.1.7.6.1.A	Engagement Status Indication	ME-023
3.9.1.7.6.1.B	Engagement Status Indication	ME-023
3.9.1.7.6.2	One-Handed Actuation	ME-028
3.9.1.7.6.3.A	Fastener Clearances	ME-024
3.9.1.7.6.3.B	Fastener Clearances	ME-024
3.9.1.7.6.3.C	Fastener Clearances	ME-024

TABLE 4-1 IRD TRACEABILITY MATRIX

IRD Par. #	IRD Requirement Title	VDS #
3.9.1.7.6.4	Fastener Access Holes	ME-020
3.9.1.7.6.5.A	Captive Fasteners	ME-025
3.9.1.7.6.5.B	Captive Fasteners	ME-025
3.9.1.7.6.6.A	Quick Release Fasteners	ME-025
3.9.1.7.6.6.B	Quick Release Fasteners	ME-025
3.9.1.7.6.7.A	Over Center Latches	ME-026
3.9.1.7.6.7.B	Over Center Latches	ME-026
3.9.1.7.6.7.C	Over Center Latches	ME-026
3.9.1.7.6.8.A	Fastener Heads and Knobs	ME-027
3.9.1.7.6.8.B	Fastener Heads and Knobs	ME-027
3.9.1.7.6.9.A	Contingency Override	ME-025
3.9.1.7.6.9.B	Contingency Override	ME-025
3.9.1.7.7	CONTROLS AND DISPLAYS	TITLE
3.9.1.7.7.1.A	Contingency Extravehicular Activity Controls	ME-030
3.9.1.7.7.1.B	Contingency Extravehicular Activity Controls	ME-029
3.9.1.7.7.2.A	Displays	ME-041
3.9.1.7.7.2.B	Displays	ME-041
3.9.1.7.7.3	Labeling	ME-037
3.9.2	MAINTENANCE	TITLE
3.9.2.1	Planned Maintenance or Storage	ME-048
3.9.2.2.A	On-Orbit Maintenance	ME-032
3.9.2.2.B	On-Orbit Maintenance	ME-032
3.9.2.2.1	Corrective Maintenance	ME-003
3.9.2.2.2	IN SITU Maintenance	ME-003
3.9.2.2.3	Orbital Replacement Unit Intermediate Maintenance	ME-003
3.9.2.2.4	Preventive Maintenance	ME-003
3.9.2.2.5	On-Orbit Maintenance Back-up	ME-047
3.9.2.2.6	Access for On-Orbit Maintenance	ME-038
3.9.2.2.6.1	Extravehicular Activity Access to Fasteners	ME-024
3.9.2.2.7	Standard On-Orbit Diagnostic Equipment	ME-016
3.9.2.3	Ground Maintenance	ME-052
3.10.A	Nameplates and Product Marking	ME-037
3.10.B	Nameplates and Product Marking	ME-037

* The IRD requirements that have "SAFETY" in the VDS number column are included for the completeness of the design requirements. It is the responsibility of each PD to address these requirements through the PSRP.

** The IRD requirements that have "DELETED" in the VDS number column are requirements that have been deleted from SSP 57003.

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
ST-001	Structural - Structural Strength	4.3.1.1.2.2 Factor(s) of Safety (I) 4.3.1.1.2.3(A, B) Design Loads (A or T) 4.3.1.1.2.4 Payload Berthing (A) 4.3.1.1.2.5 Thermal Effects (A) 4.3.1.3.2.3.1.B UMA Mounting (A) 4.3.5.1.12(A, B) Acceleration Environment (A) 4.3.5.1.13 Vibration Environment (A) 4.3.7.4 D External Equipment Requiring Dexterous Robotic Support (A)	I, A or T			
ST-002	Structural - Crew-Applied Loads	4.3.1.1.2.1 Margins of Safety (I) 4.3.1.1.2.6 Extravehicular Activity On-Orbit Induced Loads (A) 4.3.9.1.7.5.D Covers (A) 4.3.8.3.2.1 External Limit Loads (T)	A,I,T			
ST-003	Structural - Operational Life Time	4.3.1.1.3 Design Service Life (A) 4.3.1.1.6 Attached Payload Interface Durability (A)	A			
ST-004	Structural - Natural Frequency	4.3.1.3.1.3 Attached Payload Fundamental Frequency (A or T) 4.3.7.1.G Equipment Requiring Shuttle Robotic Support (A) 4.3.7.3.1.E Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (A) 4.3.7.3 B External Equipment Requiring SSRMS Support (I) 4.3.7.4.(B&D) External Equipment Requiring Dexterous Robotic Support (A & I) 4.3.7.5.A Robotic Support Equipment Requiring Robotic Translation (A & I)	A, I, T			
ST-005	Structural - Push-Pull Forces	4.3.9.1.6.6 Installation/Removal Force (A)	A			
ST-006	Structural - Fracture Control	4.3.1.1.1.1 Fail-Safe, Safe-Life, or Low-Risk Fracture Parts (A) 4.3.1.1.1.2 Fracture Control (A)	A			
ST-007	Structural - Stiffness	4.3.1.3.1.3.2 Interface Stiffness (T)	T			
ST-008	Structural - Interfaces	4.3.1.2.1 Structural Design Interface(A) 4.3.1.3.2.3.1.A UMA Mounting (A) 4.3.7.1.M Equipment Requiring Shuttle Robotic Support (A) 4.3.7.3. J. External Equipment Requiring Space Station Remote Manipulator System Support (A) 4.3.7.3.2.B Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A&I)	A & I			
ST-009	Structural-Contact	4.3.1.3.1.3.1 Interface Preload (A)	A			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
	Loads					
ST-010	Structural-M/OD	4.3.1.1.1.3 Meteoroid and Orbital Debris Protection Requirement for External Payloads (A&I)	A&I			
ST-011	Structural-Materials Properties	4.3.1.1.7 (A&B) Structural Materials Criteria and Selection (I) 4.3.1.1.8 Structural Degradation from Material Erosion (I) 4.3.6.1 Materials and Parts Use and Selection (A)	A, I			
ME-001	Mechanical - Weight and CG	4.3.1.2.3.A Mass and Envelope Dimensions (T) 4.3.1.3.1.2.2 Mass & Center of Gravity (A) 4.3.7.1E Equipment Requiring Shuttle Robotic Support 4.3.7.4.B External Equipment Requiring Dexterous Robotic Support (A & I) 4.3.7.5.A Equipment Requiring Robotic Translation (A & I)	A&T, A&I			
ME-002	Mechanical - Mechanical Stops	4.3.1.3.2.4 (A, B) Mechanical Stop Design (A) 4.3.8.3.3.1.5.A Non-Fixed Handles Design (A or D)	A or D			
ME-003	Mechanical - Payload In-Flight Maintenance	4.3.9.1.1.1.D Manual Failure Detection, Isolation, and Recovery (A) 4.3.9.1.2 Mean Maintenance Crew Hour Per Year (A) 4.3.9.1.4 (A, B) Nonpressurized Area Equipment Maintenance Time (A) 4.3.9.1.6.7.3 Attached Payload Remove/Replace Items (A) 4.3.9.1.7.5.B Covers (A) 4.3.9.2.2.1 Corrective Maintenance (A) 4.3.9.2.2.2 In SITU Maintenance (A) 4.3.9.2.2.3 Orbital Replacement Unit Intermediate Maintenance (A) 4.3.9.2.2.4 Preventive Maintenance (A)	A			
ME-004	Mechanical-As Built Hardware	4.3.1.1 General Design Requirements (I)	I			
ME-005	Mechanical - Fiber Optical Cable Bend Radius	4.3.3.2.4.5 High Rate Data Link Fiber Optic Cable Bend Radius (I)	I			
ME-006	Mechanical - On-Orbit Operational Envelope	4.3.1.3.1.1.3(A, B) Extravehicular Activity/Robotics Operational Envelope (I) 4.3.1.3.1.1.1 Payload Attach System/Unpressurized Logistics Carrier Attach System On-Orbit Operational Envelope (I)	I			
ME-007	Mechanical - Closures and Covers	4.3.8.4.2.3 Holes (I) 4.3.8.4.2.3.1 Handrails/Holds (I) 4.3.8.4.2.4 Pinch Points (A&I) 4.3.8.4.2.5 Protective Covers for Portable Equipment (A&I) 4.3.8.4.2.6.2 Protective Covers or Guards (A&I)	A, I, A&I			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
		4.3.9.1.7.5(A, G, H) Covers (A)				
ME-008	Mechanical - Built-In Controls	4.3.8.3.2.2 Extravehicular Activity Actuated Controls (I) 4.3.8.4.2.9 Levers, Cranks, Hooks and Controls (A&I) 4.3.9.1.1.1.E Manual Failure Detection, Isolation, and Recovery (A)	A, I, A&I			
ME-009	Mechanical - Robotic Clearance Envelope	4.3.1.2.3.B Mass and Envelope Dimensions (I) 4.3.7.3.G External Equipment Requiring Space Station Remote Manipulator System Support (A) 4.3.7.3.1.A Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (I) 4.3.7.3.2.A Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (I) 4.3.7.4.B External Equipment Requiring Dexterous Robotic Support (A&I) (*Inspection part only) 4.3.7.5.A Equipment Requiring Robotic Translation (A&I) (*Inspection part only)	A & I			
ME-010	Mechanical - Payload Protrusions	4.3.1.3.1.1.2 Interface Plane Protrusion (I)	I			
ME-011	Mechanical - Equipment Installation	4.3.9.1.6.3 Incorrect Equipment Installation (A)	A			
ME-012	Mechanical - Grapple Fixture Clearance Zone	4.3.7.1.B Equipment Requiring Shuttle Robotic Support (I)	I			
ME-013	Mechanical - Alignment	4.3.1.3.2.3.B Passive Umbilical Mechanism Assembly (A) 4.3.8.3.1.1.1(A, B) Centering (A) 4.3.9.1.6.6.1 Direction of Removal (A) 4.3.9.1.6.6.2 Visibility (A)	A			
ME-014	Mechanical - Scuff Plates	4.3.7.3.F External Equipment Requiring Space Station Manipulator System Support (I) 4.3.7.1.J Equipment Requiring Shuttle Robotic Support (I)	I			
ME-015	Mechanical - Grapple Fixture Location	4.3.1.4.1.1 Grapple Fixture Locations (I) 4.3.1.4.1.2 Grapple Fixture Structural Support (A) 4.3.7.1 (C-D) Equipment Requiring Shuttle Robotic Support (I) 4.3.7.3 (K) External Equipment Requiring Space Station Remote Manipulator System Support (I)	A,I			
ME-016	Mechanical - Tools	4.3.1.4.1 Interface with NSTS Remote Manipulator System and Space Station Remote Manipulator Support (A) 4.3.9.1.7.1 Extravehicular Activity Tools (I) 4.3.9.2.2.7 Standard On-Orbit Diagnostic Equipment	A,I			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
		(A)				
ME-017	Mechanical - Connector Mating/Demating	4.3.1.3.2.3A Passive Umbilical Mechanism Assembly (A) 4.3.2.2.5.1.1 Mating/Demating of Power Connectors (A) 4.3.9.1.7.3 Connectors (I) 4.3.9.1.7.3.1A One-Handed Operation (D) 4.3.9.1.7.3.2A Mate/Demate (A)	A,I,D			
ME-018	Mechanical - Connector Arrangement and Accessibility	4.3.7.3.2.G Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (I) 4.3.9.1.7.3.1.B One-Handed Operation (D) 4.3.9.1.7.3.3(A, B) Connector Arrangement (I) 4.3.9.1.7.3.7.1(A, B) Spacing (I)	I,D			
ME-019	Mechanical - Connector Protection and Shape	4.3.9.1.7.3.2B Mate/Demate (A) 4.3.9.1.7.3.4 Connector Protection (A)	A			
ME-020	Mechanical - Alignment, Coding, and Orientation	4.3.1.3.2.2(A, B) Guide Pins (I, A) 4.3.9.1.6.6.3(A, B, C) Mounting Alignment (I) 4.3.9.1.7.2(A, B) Payload Hardware and Equipment Mounting (D & I) 4.3.9.1.7.3.5(A, B) Coding (I) 4.3.9.1.7.3.7 Orientation (I) 4.3.9.1.7.6.4 Fastener Access Holes (I)	A,I&D			
ME-021	Mechanical - Physical Interference	4.3.7.3.D External Equipment Requiring Space Station Remote Manipulator System Support (I) 4.3.7.4.(A&E) External Equipment Requiring Dexterous Robotic Support (I) 4.3.8.2.2 Extravehicular Activity Translation Corridor Protrusion (A & I) 4.3.8.3.3.1.3.B Mounted Clearance (A or D) 4.3.8.4.2 Equipment Clearance for Entrapment Hazards (A & D)	I, A&D			
ME-022	Mechanical - Hose/Cable Restraints	4.3.9.1.7.4(A, B, C, D) Cable Restraints (I)	I			
ME-023	Mechanical - Engagement Status Indication	4.3.7.1.N Equipment Requiring Shuttle Robotic Support (A or D) 4.3.7.3.E External Equipment Requiring Space Station Remote Manipulator System Support (A or D) 4.3.9.1.7.3.3.1 Status (D) 4.3.9.1.7.5.C Covers (A) 4.3.9.1.7.6.1(A, B) Engagement Status Indication (I)	I, A or D			
ME-024	Mechanical - Mounting	4.3.9.1.7.1.1(A, B, C) Tool Clearance (I) 4.3.9.1.7.6.3(A, B, C) Fastener Clearances (I)	I			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
	Bolt/Fastener Spacing and Tool Clearance	4.3.9.2.2.6.1 Extravehicular Activity Access to Fasteners (I)				
ME-025	Mechanical - Fasteners	4.3.8.4.2.7.1 Screws and Bolts (A) 4.3.8.4.2.7.2 Securing Pins (A) 4.3.8.4.2.8 Safety Critical Fasteners (T) 4.3.9.1.7.6 Fasteners (I) 4.3.9.1.7.6.5(A, B) Captive Fasteners (A) 4.3.9.1.7.6.6(A, B) Quick Release Fasteners (I) 4.3.9.1.7.6.9(A, B) Contingency Override (I)	A,I,T			
ME-026	Mechanical - Latches	4.3.8.4.2.6.1(A, B, C, D, E) Design (A) 4.3.9.1.7.6.7(A, B, C) Over Center Latches (I)	A,I			
ME-027	Mechanical - Fastener Head Type	4.3.9.1.7.6.8(A, B) Fastener Heads and Knobs (I)	I			
ME-028	Mechanical - One-Handed Operation	4.3.8.3.3.1.5.B Non-Fixed Handles Design (A or D) 4.3.9.1.6.1 Method (A) 4.3.9.1.7.6.2 One-Handed Actuation (D)	A,D A or D			
ME-029	Mechanical - Accidental Actuation Protection	4.3.1.3.2.5 Safety Interlocks (A) 4.3.9.1.7.7.1.B Contingency Extravehicular Activity Controls (I)	I,A			
ME-030	Mechanical - Position Indication	4.3.8.3.3.1.5.C Non-Fixed Handles Design (A or D) 4.3.9.1.7.7.1.A Contingency Extravehicular Activity Controls (I)	I,A or D			
ME-031	Mechanical - Tether Attach Points	4.3.8.3.3.2.1(A, B, C)Tether Attachment Points (I)	I			
ME-032	Mechanical - Restraint and Mobility Aids	4.3.8.3.3 Mobility Aids and Restraints (I) 4.3.8.3.3.1.6 Handrails/Handhold Tether Attachment (I) 4.3.8.3.3.2 Extravehicular Activity Safety Tethers and Safety Hooks (I) 4.3.8.4.2.7 Captive Parts (D) 4.3.8.4.2.7.3 Locking Wires (A) 4.3.9.1.5 Access Item Retainment (A & I) 4.3.9.1.7.3.4.1 Protecting Caps (I) 4.3.9.1.7.5.F Covers (A) 4.3.9.2.2(A, B) On-Orbit Maintenance (A)	A, D, I, A&I			
ME-033	Mechanical - Captive Parts	4.3.9.1.5.1 Captive Parts (D & I)	D & I			
ME-034	Mechanical - Handles	4.3.8.3.3.1Provide Extravehicular Activity Handles (I) 4.3.8.3.3.1.1 (A, B) Extravehicular Activity Handholds/Handrails (A) 4.3.8.3.3.1.2 Dimensions (A or D) 4.3.8.3.3.1.3(A, C) Mounted Clearance (A or D) 4.3.8.3.3.1.4.B Positioning/Location (A or D)	I,A, A or D			
ME-	Mechanical -	4.3.8.3.3.1.4.C Positioning/Location (A or D)	A or D			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
035	Labeling Functional Considerations and Payload Orientation					
ME-036	Mechanical - Interchangeability	4.3.1.1.5 Interchangeability (A)	A			
ME-037	Mechanical - Labeling Design	4.3.8.3.3.1.7 Danger Warnings (I) 4.3.8.3.5 Location Coding (A) 4.3.9.1.7.3.6 Pin Identification (I) 4.3.9.1.7.7.3 Labeling (I) 4.3.10 (A,B) Nameplates and Product Marking (I, A)	A,I			
ME-038	Mechanical - Accessibility	4.3.8.2.1 Payload Attach System/Unpressurized Carrier Cargo Attach System Interface Clearances (I) 4.3.8.3.1 Crew Access Dimensions (D) 4.3.8.3.1.1 Body Envelope and Reach Accessibility (D) 4.3.8.3.1.1.3 External Task Location Requirements (D) 4.3.8.3.3.1.4.A Positioning/Location (A or D) 4.3.8.3.4.1 Extravehicular Activity Gloved Hand Access (A or D) 4.3.9.1.3 (A, B, C, D) Access (I & A) 4.3.9.1.6.2 Equipment item Interconnection Devices (A) 4.3.9.1.6.7.1 Capture Latch Assembly & Umbilical Mechanical Assembly EVA Override (A) 4.3.9.1.6.7.2 Payload Attach System and Unpressurized Cargo Carrier Attach System Orbital Replacement Unit Extravehicular Activity Maintenance (A) 4.3.9.1.7.5.E Covers (A) 4.3.9.2.2.6 Access for On-Orbit Maintenance (A)	A, D, A or D, I & A			
ME-039	Mechanical - Lighting Design	4.3.9.1.1.1B Manual Failure Detection, Isolation, and Recovery (A)	A			
ME-040	Mechanical - Audio Device Displays	4.3.9.1.1.1C Manual Failure Detection, Isolation, and Recovery (A)	A			
ME-041	Mechanical - Displays	4.3.9.1.1.1A Manual Failure Detection, Isolation, and Recovery (A) 4.3.9.1.7.7.2(A,B) Displays (I)	A,I			
ME-042	Mechanical - Mechanical Attachment Points	4.3.1.3.2.1 (A-B) Extravehicular Activity Releasable Capture Bar (I,A) 4.3.9.1.6.4 Lockwiring and Staking (I) 4.3.9.1.6.5 (A-B) Restraining and Handling Devices for Temporary Storage (A)	A,I			
ME-043	Mechanical - Color	4.3.8.3.3.1.8 Color (I)	I			
ME-044	Mechanical - Robotic	4.3.7.5 (B, C, D) Equipment Requiring Robotic Translation (A,I)	A,I			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
	Translation	4.3.1.4.2 Interface with Special Purpose Dexterous Manipulator (A)				
ME-045	Mechanical - EVR Operation	4.3.7.3I External Equipment Requiring Space Station Remote Manipulator System Support 4.3.7.6 Camera Requirements (TBD) 4.3.9.1.7.B Standard Extravehicular Activity/Extravehicular Robotics Interfaces (A)	A			
ME-046	Mechanical - Interfaces	4.3.1.2.2 Mechanical Design Interface (I & T) 4.3.1.3.1.2.1 Payload Attach System Coordinate System Origin Location (I) 4.3.7.3.(A&K) External Equipment Requiring Space Station Remote Manipulator System Support (I) 4.3.7.3.1.B Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (I) 4.3.7.4 C External Equipment Requiring Dexterous Robotic Support (A&I)	I, I&T, A&I			
ME-047	Mechanical - EVA Contingency Operations	4.3.1.3.2.3.C Passive Umbilical Mechanism Assembly (A) 4.3.8.A Extravehicular Activity (A, D & I) 4.3.8.1 (A, B, C) Extravehicular Activity as a Backup for Robotics activities (A) 4.3.8.2 Extravehicular Activity Translation (A) 4.3.9.1.7.A Standard Extravehicular Activity / Extravehicular Activity Robotics Interfaces (A) 4.3.9.2.2.5 On-Orbit Maintenance Back-up (A)	A,D&I			
ME-048	Mechanical - Sharp Edge, Burrs and Protrusions	4.3.8.B Extravehicular Activity (A & I) 4.3.8.4.2.1.1 Sharp Edges (A & I) 4.3.8.4.2.1.1.1(A, B, C, D) Exposed Edge Requirements (A & I) 4.3.8.4.2.1.1.2(A,B) Exposed Corner Requirements (A & I) 4.3.8.4.2.1.2 Thin Materials (A & I) 4.3.8.4.2.2 Burrs (A & I) 4.3.9.2.1 Planned Maintenance and Storage (A or I)	A&I, A or I			
ME-049	Mechanical - EVA Crew Member Field of View	4.3.8.3.1.1.2 Extravehicular Activity Crew Member Field of View (A)	A			
ME-050	Mechanical -Non-Ionizing Radiation	4.3.8.4.5 Transmitters (A)	A			
ME-051	Mechanical-Robotic Hand Off	4.3.7.2 External Equipment Requiring Robotic Hand-Off (I)	I			
ME-052	Mechanical-Ground Maintenance	4.3.9.2.3 Ground Maintenance (A)	A			
ME-	Mechanical-	4.3.8.4.3 Moving or Rotating Equipment (A)	A			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
053	Protection From Moving Equipment	4.3.7.1.K Equipment Requiring Shuttle Robotic Support (A)				
ME-054	Mechanical-SPDM Fixture Locations and Structural Support	4.3.1.4.2.1 (A-B) Special Purpose Dexterous Manipulator Fixture Locations (I) 4.3.1.4.2.2 Special Purpose Dexterous Manipulator Fixture Structural Support (A)	A,I			
EL-001	Electrical - Steady-State Voltage Characteristics	4.3.2.2.1.1 Steady-State Voltage Characteristics (T) 4.3.7.3.2.D Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)	A,T			
EL-002	Electrical - Ripple Voltage Characteristics, Noise, and Spectrum	4.3.2.2.1.2.1 Ripple Voltage and Noise (A) 4.3.2.2.1.2.2 Ripple Voltage Spectrum (A) 4.3.7.3.2.D Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)	A			
EL-003	Electrical - Transient Voltages	4.3.2.2.1.3.1 Normal Transient Voltages (A or T) 4.3.7.3.2.D Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)	A or T			
EL-004	Electrical - Fault Clearing and Protection	4.3.2.2.1.3.2 Fault Clearing and Protection (A) 4.3.7.3.2 (C, D) Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A&I)	A,I			
EL-005	Electrical - Non-Normal Voltage Range	4.3.2.2.1.3.3 (A, B) Interface C Non-normal Voltage Range (A) 4.3.7.3.2.D Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)	A			
EL-006	Electrical - Connectors/ Pin Assignments	4.3.3.2.4.7 High Rate Data Link Connector/Pin Assignments (I) 4.3.2.2.2.1 (A,B) Attached Payload Connectors and Pin Assignments (I&D)	I&D			
EL-007	Electrical - Power Bus Isolation	4.3.2.2.2.2 (A, B) Power Bus Isolation (A)	A			
EL-008	Electrical - Compatibility with Soft Start/Stop RPC	4.3.2.2.2.3 Compatibility with Soft Start/Stop RPC (T)	T			
EL-009	Electrical -Surge Current	4.3.2.2.2.4(A,B) Surge Current (A&T)	A&T			
EL-010	Electrical - Reverse Energy/Current	4.3.2.2.2.5 Reverse Energy/Current (A)	A			
EL-011	Electrical - HRDL Connectors	4.3.3.2.4.6 High Rate Data Link Connectors (I)	I			
EL-012	Electrical - Large Signal Stability	4.3.2.2.2.8 Large Signal Stability (T&A)	T&A			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
EL-013	Electrical - Wire Derating	4.3.2.2.3.1 Wire Derating (A)	A			
EL-014	Electrical - Exclusive Power Feeds	4.3.2.2.3.2 Exclusive Power Feeds (D&I)	D&I			
EL-015	Electrical - Electromagnetic Interference/ Compatibility	4.3.2.2.4 Electromagnetic Compatibility (T&A) 4.3.2.2.4.4 Electromagnetic Interference (T&A) 4.3.2.2.4.6 Alternating Current Magnetic Fields (T) 4.3.2.2.4.7 Direct Current Magnetic Fields (T or A) 4.3.2.2.4.9 Electromagnetic Interference Susceptibility for Safety Critical Circuits (T&A) 4.3.7.3.2.I Equipment Requiring Space Station Remote Manipulator System Support using a Power Data Grapple Fixture (A)	T&A T or A			
EL-016	Electrical - Cable/Wire Design and Grounding	4.3.2.2.4.1 Electrical Grounding (T&A) 4.3.2.2.4.3 Cable/Wire Design and Control Requirements (T, A, or I)	T&A&I			
EL-017	Electrical - Electrical Bonding	4.3.2.2.4.2 Electrical Bonding (T, A&I)	T,A&I			
EL-018	Electrical - Electrostatic Discharge and Corona	4.3.2.2.4.5.B Electrostatic discharge (I) 4.3.2.2.4.8 Corona (T)	I,T			
EL-019	Electrical - Fiber Optic Cable Characteristics	4.3.3.2.4.4 High Rate Data Link Fiber Optic Cable (I)	I			
EL-020	Electrical - Power Switches/Controls	4.3.2.2.5.2 (A, B, C) Power Switches/Controls (I,A, A&T)	I, A&T			
EL-021	Electrical - LRDL Cabling Characteristics	4.3.3.2.3.2.3 (A,B) LRDL Cabling (I)	I			
EL-022	Electrical - Safety Requirements	4.3.2.2.5.1 Payload Electrical Safety (A) 4.3.2.2.5.1.2 Safety-Critical Circuits Redundancy (A)	A			
EL-023	Electrical - Circuit Protection Devices	4.3.2.2.6.1(A, B) International Space Station Electrical Power System Circuit Protection Characteristics (T, A) 4.3.2.2.6.2 Attached Payload Trip Ratings (T&D)	T,A, T&D			
EL-024	Electrical - Loss of Power	4.3.2.2.3.3 Loss of Power (A)	A			
EL-025	Electrical - Load Impedance's	4.3.2.2.2.7 Interface C Attached Payload Complex Load Impedance's (T)	T			
EL-026	Electrical - MCAS Interface	4.3.2.1 Electrical Interface with Mobile Servicing System MCAS (T)	T			
EL-027	Electrical - Interface	4.3.7.1.H Equipment Requiring Shuttle Robotic Support (I)	I			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
		4.3.7.3.1.G Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (I) 4.3.7.3.2.C Equipment Requiring Space Station Remote Manipulator System Support using a Power Data Grapple Fixture (I)				
CD-001	C&DH - Word/Byte Notations, Data Types, and Data Transmission	4.3.3.2.1.1 Word/Byte Notations (I&T) 4.3.3.2.1.2 Data Types (I) 4.3.3.2.1.3 (A, B) Data Transmissions (I) 4.3.3.2.2.1 (A, B) Consultative Committee For Space Data Systems Data (A or T) 4.3.3.2.2.1.1 Consultative Committee For Space Data Systems Data Packets (I&T) 4.3.3.2.2.1.1.1 Consultative Committee For Space Data Systems Primary Header (I &T) 4.3.3.2.2.1.1.2 (A, B) Consultative Committee For Space Data Systems Secondary Header (T)	I&A&T A or T			
CD-002	C&DH - CCSDS User Data Field	4.3.3.2.2.1.2 Consultative Committee For Space Data Systems Data Field (T)	T			
CD-003	C&DH - CCSDS Time Codes	4.3.3.2.2.2.1 Consultative Committee For Space Data Systems Unsegmented Time (T)	T			
CD-004	C&DH - LRDL Protocol	4.3.3.2.3 (A&B) MIL-STD-1553B Low Rate Data Link (I&T) 4.3.3.2.3.1 MIL-STD-1553 Protocol 4.3.3.2.3.1.1(A, B) Standard Messages (I&T) 4.3.3.2.3.1.2(A, B) Commanding (I&T) 4.3.3.2.3.1.3 (A,B,C) Health and Status Data (A, I, T) 4.3.3.2.3.1.4 (A, B) Safety Data (T) 4.3.3.2.3.1.4.1.2(A,B) Class 2-Warning (A&T) 4.3.3.2.3.1.4.1.3(A, B) Class 3-Caution (A&T) 4.3.3.2.3.1.4.1.4(A, B) Class 4-Advisory (A&T)	I&A&T			
CD-005	C&DH - LRDL Messages	4.3.3.2.3.1.5 Service Requests (I&T) 4.3.3.2.3.1.6 Ancillary Data (I&T) 4.3.3.2.3.1.7 File Transfer (I&T) 4.3.3.2.3.1.8 Low Rate Telemetry (I&T)	I&T			
CD-006	C&DH - LRDL Mode Codes	4.3.3.2.3.1.10 Implemented Mode Codes (I&T)	I&T			
CD-007	C&DH - LRDL Illegal Commands Error	4.3.3.2.3.1.11 Illegal Commands (T)	T			
CD-008	C&DH - LRDL Signal Characteristics	4.3.3.2.3.2.2 (A, B)LRDL Signal Characteristics (T)	T			
CD-009	C&DH - LRDL Connector/Pin	4.3.3.2.3.2.1 LRDL Connector/Pin Assignment (I&T)	I&T			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
	Assignment					
CD-010	C&DH- HRDL Signal, Symbols and Encoding	4.3.3.2.4.1 Payload to High Rate Frame Multiplexer Protocols (I&T) 4.3.3.2.4.2.1 Physical Signaling (T&A) 4.3.3.2.4.2.2 Encoding (I&T) 4.3.3.2.4.2.3 Symbols Used In Testing (T)	T&A I&T, T			
CD-011	C&DH - HRDL Send/Receive Optical Power	4.3.3.2.4.3.1 High Rate Data Link Transmitted Optical Power (T) 4.3.3.2.4.3.2 High Rate Data Link Received Optical Power (T)	T			
CD-012	C&DH - Portable Computer System	4.3.3.2.5 Portable Computer System (A)	A			
CD-013	C&DH- MSS Interface	4.3.3.1 Command and Data Handling Interface With Mobile Servicing System (T)	T			
CD-014	C&DH – Data/Video	4.3.7.3.2 (E-F) Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (I)	I			
EN-001	Environmental - External Contamination	4.3.5.1.5.1 Molecular Column Density from Venting, Leakage and Outgassing (A) 4.3.5.1.5.2 (A&B)Molecular Deposition from Materials Outgassing and Venting (T)	A,T			
EN-002	Environmental - Ionizing Radiation Dose	4.3.5.1.8.1 Attached Payload Contained or Generated Ionizing Radiation (A) 4.3.5.1.8.2 Ionizing Radiation Dose (A) 4.3.5.1.8.3 Nominal Single Event Effects Ionizing Radiation (A) 4.3.5.1.8.4 Extreme Single Event Effects (A) 4.3.8.4.4 Power Sources (A)	A			
EN-003	Environmental – Microgravity	4.3.1.3.2.6 Microgravity (TBD) 4.3.1.3.2.6.1 Limit Quasi-Steady Accelerations (TBD) 4.3.1.3.2.6.2 Limit Vibratory and Transient Accelerations (TBD)	TBD			
MP-001	Materials - Cleanliness	4.3.6.3 Cleanliness (I)	I			
MP-002	Materials - Commercial Parts	4.3.6.2 Commercial Parts (I)	I			
MP-003	Materials - Surface Materials	4.3.61.1 Thermal Coating (I)	I			
TC-001	Thermal - External Touch Temperature	4.3.8.4.1.1 Incidental Contact (A) 4.3.8.4.1.2 Unlimited Contact (A)	A			
TC-002	Thermal- Interfaces	4.3.7.1.I Equipment Requiring Shuttle Robotic Support (I) 4.3.7.3.1.F Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (I)	A, I			

Table 4-2 VDS TO IRD SECTION 4 CROSS-REFERENCE MATRIX

Number	Title	IRD Section 4 Number(s), Title(s), and Method(s)	Method	*Hazard Number (original)	*Hazard Number (re-flight)	Safety Yes/No
		4.3.7.3.2.H Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)				
TC-003	Thermal-Design	4.3.4.1.1 Passive Thermal Control Design Requirements For Payload On Integrated Truss Segment S3 Payload Attach System and P3 Unpressurized Cargo Carrier Attach System (A) 4.3.4.1.1.1 Temperature Requirement (A) 4.3.4.1.1.3 Incident Solar Energy (A)	A			
TC-004	Thermal- Radiation	4.3.4.1.1.4 Heat Radiation (A)	A			

*NOTE: The “Safety Yes/No” and the “Hazard Number” columns are included as aids in the construction of the Unique PVPs

APPENDIX A
ABBREVIATIONS AND ACRONYMS

ac	Alternating Current
ANSI	American National Standards Institute
AP	Attached Payload
APIRD	Attached Payload Interface Requirements Document
APM	Attached Pressurized Module
APPI	Attached Payload Port Interface
ASTM	American Society for Testing and Materials
BER	Bit Error Rate
BIT	Built-in-Test
BWAD	Bridge Wire Actuated Device
C	Centigrade
cc	Cubic Centimeter
C&DH	Command and Data Handling
CCSDS	Consultative Committee for Space Data Systems
Cert	Certification
CG	Center of Gravity
CLA	Capture Latch Assembly
cm	Centimeter
COC	Certificate of Compliance
COU	Concept of Operations and Utilization
COFR	Certification Of Flight Readiness

COTS	Commercial Off The Shelf
CR	Change Request
CS	Conducted Susceptibility
D	Demonstration
dB	Decibel
dc	Direct Current
DCL	Design Coupled Loads
DLA	Design Loads Analysis
EEE	Electrical, Electronic and Electromechanical
e.g.	For Example
EL	Electrical
EMC	Electromagnetic Compatibility
EME	Electromagnetic Effects
EMI	Electromagnetic Interference
EMU	Extravehicular Maneuvering Unit
EN	Environmental
EPCE	Electrical Power Consuming Equipment
EPS	Electrical Power System
ESD	Electrostatic Discharge
Etc.	Etceteras
EUT	Equipment Under Test
EVA	Extravehicular Activities
EVR	Extravehicular Robotics

EXPRESS Expedite the Processing of Experiments to Space Station

F Fahrenheit

FCSD Flight Crew Support Division

FEM Finite Element Model

FMEA Failure Modes and Effects Analysis

FN Functionality

Ft. Feet

GAPVP Generic Attached Payload Verification Plan

GF Grapple Fixture

Gm gram mass

GSE Ground Support Equipment

hr Hour

HOSC Huntsville Operations Support Center

HRDL High Rate Data Link

HRFM High Rate Frame Multiplexer

H/W Hardware

Hz Hertz

IDD Interface Definition Document

i.e. That is

ICD Interface Control Document

IEEE Institute of Electrical and Electronic Engineers

in	Inches
IRD	Interface Requirements Document
ISS	International Space Station
ITA	Integrated TRUSS Assembly
IVA	Intravehicular Activities
JSC	Johnson Space Center
kg	Kilograms
kHz	Kilohertz
kPa	KiloPascal
KSC	Kennedy Space Center
kW	Kilowatt
lbf	Pounds Force
lbm	Pounds Mass
lbs	Pounds
LEE	Latching End Effector
LRDL	Low Rate Data Link
LSA	Logistics Support Analysis
LSAR	Logistics Support Analysis Record
m	meter
max	Maximum
Mbps	Megabits per Second

MBS	Mobile Base System
MCAS	Mobile Base System Common Attach System
MDM	Multiplexer-Demultiplexer
ME	Mechanical
MHz	Megahertz
MIL-STD	Military Standard
min	Minimum
M/OD	Meteoroids and Orbital Debris
mm	Millimeter
MMCH/Y	Mean Maintenance Crew Hour Per Year
MP	Materials and Processes
MRDL	Medium Rate Data Link
MSFC	Marshall Space Flight Center
N	Newton
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NDE	Nondestructive Evaluation
NSTS	National Space Transportation System
NVR	No Verification Required
ORU	Orbital Replacement Units
P3	Integrated Truss Segment Port 3
par	Paragraph

PAS	Payload Attach System
PCB	Payload Control Board
PD	Payload Developer
PDGF	Power Data Grapple Fixture
PDL	Payload Data Library
PDRP	Payload Display Review Panel
PEI	Payload Engineering and Integration
PL	Payloads
POA	Payload/ORU Accommodations
PRCU	Payload Rack Checkout Unit
PSCP	Payload Software Control Panel
psi	Pounds per Square Inch
PSIV/F	Payload Software Integration and Verification Facility
PSRP	Payload Safety Review Panel
PVP	Payload Verification Plan
QCM	Quartz Crystal Measurement
RBDA	Reliability Block Diagram Analysis
Rev	Revision
RLA	Repair Level Analysis
RMS	Remote Manipulator System
RPC	Remote Power Controller
S3	Integrated Truss Segment Starboard 3
SA	Safety

SCS	Safety Critical Structures
sec	Second
SINDA	Systems Improved Numerical Differencing Analyzer
Slpm	Standard Liter Per Minute
SPDM	Special Purpose Dexterous Manipulator
SPEC	Specification
SRMS	Shuttle Remote Manipulator System
SSP	Space Station/Shuttle Program
SSQ	Space Station Qualified
SSRMS	Space Station Remote Manipulator System
ST	Structural
STD	Standard
STEP	Suitcase Test Equipment for Payloads
SW	Software
TBD	To Be Determined
TBE	Teledyne Brown Engineering
TM	Technical Memo
TRASYS	Thermal Radiation Analyzer System
UCCAS	Unpressurized Cargo Carrier Attach System
ULCAS	Unpressurized Logistics Carrier Attach System
UMA	Umbilical Mechanism Assembly
US	United States
USL	United States Laboratory

V	Volts
VC-S	Visibly Clean-Sensitive
VCL	Verification Coupled Loads
Vdc	Volts Direct Current
VDS	Verification Definition Sheet
VLA	Verification Loads Analysis
Vrms	Volts root mean square

Appendix B Verification Definition Sheets

Number ST-001	Title STRUCTURAL - STRUCTURAL STRENGTH	Method I, A or T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): <div style="display: flex; justify-content: space-between;"> <div> 4.3.1.1.2.2 Factor(s) of Safety (I) 4.3.1.1.2.3 (A-B) Design Loads (A or T) 4.3.1.1.2.4 Payload Berthing (A) 4.3.1.1.2.5 Thermal Effects (A) </div> <div> 4.3.1.3.2.3.1B UMA Mounting (A) 4.3.5.1.12 (A-B) Acceleration Environment (A) 4.3.5.1.13 Vibration Environment (A) 4.3.7.4 D External Equipment Requiring Dexterous Robotic Support </div> </div>			
Requirement Summary: These requirements address the structural strength of Attached Payloads. The Attached Payloads safety-critical structure (SCS) must be able to withstand the random vibration, and loads due to on-orbit acceleration.			
Detailed Descriptions of Requirements: All Attached Payloads SCS elements will be included in this requirement, i.e., load carrying members. Verify by stress analysis using appropriate factors of safety that all safety critical structures have positive margins of safety. Structural design and analysis criteria as specified in SSP 52005 shall be used. Strength of the Attached Payloads shall be verified for the on-orbit mission and shall use loads environments developed from the appropriate combination of random vibration, acceleration, and thermal environments as specified. On-orbit loads shall be based on the acceleration as specified in SSP 57003, paragraph 3.5.1.12 (A, B)			
Required Verification Data: 1. Data Cert. that provides a summary of the margins of safety for all SCSs identified in accordance with SSP 52005 using design loads. 2. Data Cert. that provides a summary of the margins of safety for all SCS identified in accordance with SSP 52005 using loads from the Design Loads Analysis (DLA) results. 3. Data Cert. that provides a summary of the margins of safety for all SCS identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results.			Data Submittal Dates: 1. L-22 2. L-12 3. L-5
Description of Reverification Requirements:		Reverification Method: I, A or T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.			Data Submittal Dates: I. N/A II. Same as original submittal dates
Applicable Document(s): SSP 52005, Entire Document SSP 57003, par. 3.1.1.2.2, 3.1.1.2.3, 3.1.1.2.4, 3.1.1.2.5, 3.5.1.13, 3.5.1.12,			

Appendix B Verification Definition Sheets

Number ST-002	Title STRUCTURAL - CREW-APPLIED LOADS	Method A, I, T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.1.2.1 Margins of Safety (I) 4.3.1.1.2.6 Extravehicular Activity On-Orbit Induced Loads (A) 4.3.8.3.2.1 External Limit Loads (T) 4.3.9.1.7.5D Covers (A)			
Requirement Summary: These are requirements that address the ability of the Attached Payloads to withstand crew-applied loads for all operational modes.			
Detailed Descriptions of Requirements: Verify the capability of all payload equipment that has a potential interface with the crew for operation, use, or impact (whether inadvertent or not) to withstand crew applied loads as specified in SSP 57003, paragraph 3.1.2.6. Verify by stress analysis, using appropriate factors of safety, that all structures have positive margins of safety.			
<u>EVA On-Orbit Induced Loads</u> Verification shall be by analysis. The analysis shall show that the Attached Payload is capable of reacting the loads defined in Tables 3.1.1.2.6–1 and 3.1.1.2.6–2. Verification shall be considered successful when the analysis shows that the Attached Payload is capable of withstanding the specified loads.			
<u>External Limit Loads</u> External hardware with crew or crew actuated tool interfaces shall be verified by thermal vacuum test. The test shall consist of measuring the forces required to actuate the hardware under the full range of thermal and vacuum conditions expected on-orbit. The verification shall be considered successful when the test data shows that the actuation forces for crew or crew actuated tool interfaces are in accordance with SSP 57003, Table 3.1.1.2.6-2.			
<u>Covers</u> An analysis of payload hardware and flight drawings shall be performed to verify that non-structural closures are capable of sustaining EVA – induced loads as specified in SSP 57003, Table 3.1.1.2.6-1.			
Required Verification Data: 1. Data Cert. providing a summary listing of all operational modes analyzed and showing positive margins of safety.			Data Submittal Dates: 1. L-12
Description of Reverification Requirements:		Reverification Method: A, I, T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required.			
II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A			Data Submittal Dates: I. N/A
II. Same as the “Required Verification Data” identified above.			II. L-12
Applicable Document(s): SSP 57003, par. 3.1.1.2.1, 3.1.1.2.6, 3.8.3.2.1, 3.9.1.7.5			

Appendix B Verification Definition Sheets

Number ST-003	Title STRUCTURAL – OPERATIONAL LIFE TIME	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.1.3 Design Service Life(A) 4.3.1.1.6 Attached Payload Interface Durability (A)			
Requirement Summary: These requirements define the Attached Payload operating life time and operations cycles			
Detailed Descriptions of Requirements: A review of the structural analysis reports shall be performed to verify that the analysis is in conformance with the specified requirements for all structural components. When it is shown that Attached Payload structural components satisfy the maximum expected design life in SSP 57003, paragraph 3.1.1.3 and have been analyzed in conformance with the requirements as specified in SSP 30559, paragraph 3.5, using the methods defined in SSP 52005, then the verification will be satisfied. An analysis shall be performed using mate and demate mechanism test data, item structural data, and material and parts data to verify interface durability. The verification shall be considered successful when the analysis shows that the on-orbit Attached Payload interface to ISS will perform its intended function following the number of mate and demate cycles specified in SSP 57003, paragraph 3.1.1.6.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC.			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 30559, par. 3.5 SSP 57003, par. 3.1.1.3 & 3.1.1.6. SSP 52005			

Appendix B Verification Definition Sheets

Number ST-004	Title STRUCTURAL – NATURAL FREQUENCY	Method A, I, T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.1.3 Attached Payload Fundamental Frequency (A or T) 4.3.7.1G Equipment Requiring Shuttle Robotic Support (A) 4.3.7.3B External Equipment Requiring Space Station Remote Manipulator System Support (I) 4.3.7.3.1E Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (A) 4.3.7.4 (B&D) External Equipment Requiring Dexterous Robotic Support (A & I) (*Analysis part only) 4.3.7.5A Robotic Support Equipment Requiring Robotic Translation (A & I)			
Requirement Summary: These requirements address the natural frequencies of Attached Payloads.			
Detailed Descriptions of Requirements: The Attached Payload minimum fundamental frequency shall be determined by analysis or by dynamic testing (model survey or vibration test). Analysis shall be performed using the guidelines provided in accordance with SSP 52005, Appendix C.1.2.2, and Finite Element Model (FEM) that has been developed in accordance with SSP 52005 paragraphs 6.1.1.2, 6.1.1.3, and 7.1. Verification shall be considered successful when the analysis or test shows the Attached Payload meets the requirements of SSP 57003, paragraph 3.1.3.1.3. The vibration frequency of an Attached Payload requiring SSRMS support shall be performed via analysis and verified to be in accordance with SSP 42004, section A3.2.2.3.2. The vibration frequency of an Attached Payload requiring SRMS support shall be in accordance with NSTS 21000-IDD-ISSa, paragraph 14.4.5.2 and verified by analysis. An inspection of flight drawings shall be performed to verify that Attached Payloads required SSRMS support are within the robotic properties as identified in SSP 57003, Table 3.7.3-1. An Attached Payload which requires dexterous robot support or robot support equipment requiring robotic translation, shall be verified via a structural analysis that the Attached Payload is within the frequency limits specified in SSP 57003, Tables 3.7.4-1 and 3.7.5-1.			
Required Verification Data: 1. Finite Element Model or Data Cert. 2. Verified Finite Element Model or Updated Data Cert.		Data Submittal Dates: 1. L-18 2. L-9	
Description of Reverification Requirements:		Reverification Method: A, I, T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC.		Data Submittal Dates: I. N/A II. L-12	
Applicable Document(s): SSP 52005, par. 6.1.1.2, 6.1.1.3, 7.1, and App. C par. 1.2.2 SSP 57003, par. 3.1.3.1.3, 3.7.1, 3.7.3.1, 3.7.4, and 3.7.5. Tables 3.7.5-1 and 3.7.5-1.			

Appendix B Verification Definition Sheets

Number ST-005	Title STRUCTURAL – PUSH-PULL FORCES	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.6.6 Installation/Removal Force (A)			
Requirement Summary: This requirement ensures that the crew will be physically capable of operating equipment that requires push-pull actions.			
Detailed Descriptions of Requirements: Push-Pull forces shall be verified by analysis. Verification shall be considered successful when an analysis of the payload flight hardware shows that hardware mounted into a capture-type receptacle that requires push-pull action requires a force less than 156 N (35lbf) to install and remove.			
Required Verification Data: 1. Certificate of Compliance (COC)		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A	Hazard Report(s):
Required Reverification Data: I. N/A II. COC.		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.9.1.6.6			

Appendix B Verification Definition Sheets

Number ST-006	Title STRUCTURAL – FRACTURE CONTROL	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.1.1.1 Fail-Safe, Safe-Life, or Low-Risk Fracture Parts (A) 4.3.1.1.1.2 Fracture Control (A)			
Requirement Summary: Each Attached Payload must be capable of withstanding the design load environment throughout its design life.			
Detailed Descriptions of Requirements: An analysis shall be performed using test or analysis data in accordance with SSP 52005, section 5.3.2. When it is shown that the Attached Payload structural components and materials can be classified as fail-safe, safe-life, or low-risk and that the primary structure has +0.00 or positive safety margins with respect to the loads used in the component/material analyses during ascent, on-orbit, and descent, then the verification will be satisfied. Critical flaw sizes that result from the fracture mechanics analysis will determine any requirements for Nondestructive Evaluation (NDE) of structural parts. Fracture control planning, analysis, inspection requirement, and inspection results shall be performed per a user-developed Fracture Control Plan approved by the PSRP. NDE inspection is defined in SSP 52005, Section 7.5.			
Required Verification Data: 1. Fracture Control Plan (submitted for PSRP approval during preliminary design phase). 2. Data Cert. providing a fracture control summary.			Data Submittal Dates: 1. L-22 2. L-12
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A	Hazard Report(s):
Required Reverification Data: I. N/A II. Data Cert. providing a fracture control summary.			Data Submittal Dates: I. N/A II. L-12
Applicable Document(s): NASA-STD-5003 SSP 52005, par. 5.3.2 and 7.5 SSP 57003, par. 3.1.1.1.1 and 3.1.1.1.2.			

Appendix B Verification Definition Sheets

Number ST-007	Title STRUCTURAL - STIFFNESS	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.1.3.2 Interface Stiffness (T)			
Requirement Summary: Attached Payload structural stiffness requirements			
Detailed Descriptions of Requirements: Verification shall be by test to determine that the capture bar stiffness meets the requirements defined in SSP 57003 paragraph 3.1.3.1.3.2. The stiffness is measured with the passive half of the Payload Attach System (PAS) simply supported on the guide pins while a load is applied where the capture latch closes on the capture bar.			
Required Verification Data: 1. Certificate of Compliance (COC)			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: A. N/A II. Same as the original submittal dates
Applicable Document(s): SSP 57003 par., 3.1.3.1.3.2			

Appendix B Verification Definition Sheets

Number ST-008	Title STRUCTURAL – INTERFACES	Method A&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.2.1 Structural Design Interface (A) 4.3.1.3.2.3.1A UMA Mounting (A) 4.3.7.1M Equipment Requiring Shuttle Robotic Support (A) 4.3.7.3J. External Equipment Requiring Space Station Remote Manipulator System Support (A) 4.3.7.3.2B Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A&I)			
Requirement Summary: This requirement ensures that the Attached Payload interfaces with and does not produce forces that exceed the strength of the attach-points.			
Detailed Descriptions of Requirements: An analysis shall be performed to verify that the Attached Payloads structural interface with the Mobile Base System Common Attach System (MCAS) meets the requirements of SSP 42004, paragraph B3.2.2.3. Verification of the Umbilical Mechanism Assembly (UMA) Mounting shall be by analysis. Verification shall be considered successful when the analysis shows that the Attached Payload structurally and mechanically interfaces with the passive UMA as shown in SSP 57004, Figure 3.1.2.2-1. Verification shall be by analysis to show that Attached Payloads requiring SRMS and SSRMS support have berthing mechanisms which have a capture envelop larger than the SRMS or SSRMS placement accuracy specified in SSP 57003, Table 3.7.1-1 when using just the SRMS or SSRMS. An analysis and inspection shall be performed to verify that the Attached Payload requiring SSRMS support provides both the structural and mechanical interface in accordance with SSP 42004, paragraph A3.2.2.2 and section A.3.2.2.3, and NSTS 21000-IDD-ISS, Figure 14.4.3-2, sheets one and two.			
Required Verification Data: 1. Preliminary Data Cert. based on static analysis using approved Finite Element Model (FEM) (or Design Coupled Loads (DCL) analysis results), providing the interface attach point forces and margins of safety calculations based on the allowable limits as specified 2. Final Data Cert. providing the interface attach point forces and margins of safety calculations based on the allowable limits as specified. (Attachment force can be obtained from the result of the Verification Coupled Loads (VCL)).		Data Submittal Dates: 1. L-12 2. L-5	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A&I	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above for item 2.		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.1.2.1, 3.1.3.2.3.1, 3.7.1 and 3.7.3.2.			

Appendix B Verification Definition Sheets

Number ST-009	Title STRUCTURAL-CONTACT LOADS	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.1.3.1 Interface Preload (A)			
Requirement Summary: These requirements define the capability to withstand contact loads			
Detailed Descriptions of Requirements: An analysis shall be performed on the Attached Payload hardware to show that it will withstand a minimum preload of 3500lbs and a maximum of 4700lbs from the PAS/UCCAS capture latch.			
Required Verification Data: 1. Certification of Compliance (COC)			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.1.3.1.3.1			

Appendix B Verification Definition Sheets

Number ST-010	Title STRUCTURAL-Meteoroids and Orbital Debris (M/OD)	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.1.1.3 Meteoroid and Orbital Debris Protection Requirement for External Payloads (A)			
Requirement Summary: Attached Payload Meteoroid and Orbital Debris augmentation provisions			
Detailed Descriptions of Requirements: An analysis shall be performed on Meteoroid and Orbital Debris critical components or sub-components to verify that the hardware meets the requirements of SSP 52005, paragraph 5.1.5. Verification shall be considered successful when the analysis shows the requirements of SSP 52005 are satisfied.			
Required Verification Data: 1. Certification of Compliance (COC)			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.1.1.1.3 SSP 52005, paragraph 5.1.5			

Appendix B Verification Definition Sheets

Number ST-011	Title STRUCTURAL-MATERIALS PROPERTIES	Method A, I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.1.7 (A, B) Structural Materials Criteria and Selection (I) 4.3.1.1.8 Structural Degradation from Material Erosion (I) 4.3.6.1 Materials and Parts Use and Selection (A)			
Requirement Summary: Attached Payloads required to meet material selection criteria for ISS			
Detailed Descriptions of Requirements: An inspection shall be performed of the Attached Payload structure production drawings to verify that materials have been selected which meet the criteria as specified in paragraph 3.1.1.8 and NSTS 1700.7, ISS Addendum, paragraph 208.3. A review of the structural analysis reports shall be performed to verify that potential structural erosion effects have been included in the analysis of the structure. When it is shown that Attached Payload structural components have a positive margin of safety for the required combined loads conditions, as specified in SSP 30425, then the verification shall be satisfied. Verification will be considered successful when the inspection shows that the mechanical properties and the structural material selection are in accordance with the requirements and the MSFC and/or JSC Materials Analysis and Evaluation Boards (or equivalent) approved the selection and use of all materials comprising the Attached Payload. The Attached Payload developer will be required to provide this approval to the PSRP in order to close associated Payload Safety Hazard Reports.			
Required Verification Data: 1. Certificate of Compliance (COC)		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A&I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): NSTS 1700.7 ISS Addendum SSP 30425 SSP 57003, par. 3.1.1.7, 3.1.1.8, 3.6.1			

Appendix B Verification Definition Sheets

Number ME-001	Title MECHANICAL – WEIGHT AND CG	Method A&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.2.3A Mass and Envelope Dimensions (T) 4.3.1.3.1.2.2 Mass & Center of Gravity (A) 4.3.7.1E Equipment Requiring Shuttle Robotic Support 4.3.7.4B External Equipment Requiring Dexterous Robotic Support (A&I) (*The analysis portion only) 4.3.7.5A Equipment Requiring Robotic Translation (A&I) (*The analysis portion only)			
Requirement Summary: This requirement ensures that the weight and center of gravity (CG) of each Attached Payload is within specified limits.			
Detailed Descriptions of Requirements: Determine the actual weight of an Attached Payload by analysis based on test data, including any stowage items, dexterous external equipment, equipment requiring robotic translation, and any PD-provided ancillary equipment. Allowable tolerance shall be ± 5.0 lbs or 0.3%, whichever is greater. The actual mass of the Attached Payload shall be no greater than the control mass as specified in SSP 57003, paragraph 3.1.3.1.2.2. Determine the actual CG by analysis based on test data of the Attached Payload in three orthogonal axes. Allowable tolerance shall be ± 0.25 in. in all three axes. This requirement shall be verified by analysis. The verification shall be considered successful when the analysis shows compliance with the requirement as specified. A Mass Properties summary including the CG and the weight of the Attached Payload and all PD-provided ancillary equipment is required for both launch and landing scenarios.			
Required Verification Data: 1. Data Cert. that provides weight and CG summary for on-orbit configuration of the Attached Payload		Data Submittal Dates: 1. L-7	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A&T	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.		Data Submittal Dates: I. N/A II. L-7	
Applicable Document(s): SSP 57003, par. 3.1.2.3, 3.1.3.1.2.2, 3.7.4, and 3.7.5. Note: For 4.3.7.4.B and 4.3.7.5.A the inspection part of the verification is covered as part of ME-009.			

Appendix B Verification Definition Sheets

Number ME-002	Title MECHANICAL - MECHANICAL STOPS	Method A or D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.2.4 (A, B) Mechanical Stop Design (A) 4.3.8.3.3.1.5A Non-Fixed Handles Design (A or D)			
Requirement Summary: This requirement ensures that all mechanical stops are provided as required.			
Detailed Descriptions of Requirements: Mechanical stop verification shall be performed by analysis. Verification shall be considered successful when it has been shown that: 1). The Attached Payload on orbit flight drawings and design includes mechanical stops for all gimbaled and mechanical actuating devices, 2). The mechanical actuating devices are designed with the mechanical strength necessary to absorb the maximum expected energy when contact is made using the factors of safety defined in SSP 52005, and 3). The mechanical stops have been designed for four times the number of expected duty cycles. Non-Fixed Handle design verification shall be performed by analysis or demonstration. The verification shall be considered successful when the analysis or demonstration shows that there is a stop position for holding the handle perpendicular to the surface on which it is mounted.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method: A or D	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.1.3.2.4, and 3.8.3.3.1.5. SSP 52005			

Appendix B Verification Definition Sheets

Number ME-003	Title MECHANICAL – PAYLOAD IN-FLIGHT MAINTENANCE	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.1.1D Manual Failure Detection, Isolation, and Recovery (A) 4.3.9.1.2 Mean Maintenance Crew Hour Per Year (A) 4.3.9.1.4 (A-B) Non-pressurized Area Equipment Maintenance Time (A) 4.3.9.1.6.7.3 Attached Payload Remove/Replace Items (A) 4.3.9.1.7.5B Covers (A)			
Requirement Summary: These requirements ensure that Attached Payloads with planned in-flight maintenance can be maintained in accordance with program-level maintenance requirements.			
Detailed Descriptions of Requirements: <u>Manual Failure, Detection, Isolation, and Recovery</u> For Attached Payloads with planned in-flight maintenance, verification shall be by analysis using data from Hazard Analysis Reports, Reliability Block Diagram Analysis (RBDA), Failure Modes Effects Analysis (FMEA), schematics Logistics Support Analysis Record (LSAR) and software detailed design drawings. The verification shall be considered successful when the analysis shows that human/equipment interfaces such as visual displays devices, cursor control devices, and manual input devices have been developed in accordance with SSP 50005, paragraph 12.3.2.1.			
<u>Mean Maintenance Crew Hour Per Year (MMCH/Y)</u> For Attached Payloads with planned in-flight maintenance, an analysis shall be performed to verify that the Attached Payload design does not require more than 8 hours MMCH/Y. Verification shall be considered successful when the analysis shows the design meets the requirements.			
<u>Non-Pressurized Area Equipment Maintenance Time</u> For Attached Payloads with planned in-flight maintenance, verification shall be performed by analysis consisting of integrating program generated documentation from maintainability data and data made available during engineering tests and work-site analysis. The verification shall be considered successful when the equipment is shown to have been designed such that maintenance tasks can be completed in a single EVA sortie of less than 3 hours. In the event, that work-site maintenance tasks exceed 3 hours, the tasks shall be partitioned and safed into subtasks of less than 3 hours, so that the task can be resumed on a succeeding EVA.			
<u>Attached Payload ORU Remove and Replace Items</u> For Attached Payloads with planned in-flight maintenance, verification shall be performed by analysis to determine if Orbital Replacement Unit (ORU) items designed for dexterous robotic manipulation have also been designed to be maintainable via an EVA. The analysis shall be performed using maintainability data to define those repairs to be performed on-orbit and then determine, by applying the requirements in SSP 50005, whether or not an EVA capability for each ORU item exists. The verification shall be considered successful when the analysis shows that the ORU items are able to maintainable via an EVA.			
<u>Covers/Closures</u> For Attached Payloads with planned in-flight maintenance, verification shall be performed by analysis of the payload hardware and flight drawings to verify that all covers/closures are removable to allow for equipment maintenance.			
<u>Corrective, Preventative, and ORU Intermediate Maintenance</u> For Attached Payloads with planned in-flight maintenance, verification shall be performed by analysis using FMEA, ORU selection rational, and preventive maintenance analysis. The verification shall be considered successful when the analysis shows that the selected Logistics Support Analysis Record (LSAR) on-orbit intermediate, preventative and corrective maintenance tasks: (1) comply with the ORU selection criteria, (2) rectify the projected failure modes, (3) satisfy			

Appendix B Verification Definition Sheets

Number ME-003	Title MECHANICAL – PAYLOAD IN-FLIGHT MAINTENANCE	Method A	Hazard Report(s)
preventive maintenance analysis restrictions, and (4) meet program defined resupply, return, and crew time allocations.			
<u>IN SITU Maintenance</u> For Attached Payloads with planned in-flight maintenance, verification shall be performed by analysis using FMEA, ORU maintenance planning, and preventive maintenance analysis. The verification shall be considered successful when the analysis proves that the selected LSAR on-orbit in situ maintenance tasks rectify projected failure modes not correct by ORU removal and replacement without operational degradation and also satisfy preventative maintenance analysis restrictions.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.9.1, 3.9.1.1.1D, 3.9.1.2, 3.9.1.4, 3.9.1.6.7.3, 3.9.1.7.5, 3.9.2.2.1, 3.9.2.2.2, 3.9.2.2.3, and, 3.9.2.2.4 SSP 50005, par. 12.3.2.1			

Appendix B Verification Definition Sheets

Number ME-004	Title MECHANICAL – AS-BUILT HARDWARE	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.1 General Design Requirements (I)			
Requirement Summary: Attached payload hardware design drawings, exceedances, deviations, waivers and engineering change requests shall reflect the as-built attached payload hardware.			
Detailed Descriptions of Requirements: Attached payload hardware shall be inspected and certified that design drawings, exceedances, deviations, waivers, and engineering change requests reflect the as-built hardware. Verification shall be considered successful when the inspection shows that the as-built hardware matches the drawings and the drawings match the as-built hardware.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.1.1			

Appendix B Verification Definition Sheets

Number ME-005	Title MECHANICAL – FIBER OPTICAL CABLE BEND RADIUS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.4.5 High Rate Data Link Fiber Optic Cable Bend Radius (I)			
Requirement Summary: ISS interface fiber optic cable routing, installation, and handling procedures must be adequate to prevent the fiber optic cable from being bent beyond the allowable limits.			
Detailed Descriptions of Requirements: The Attached Payload shall develop the routing, installation and handling procedures to assure that a fiber optic cable minimum bend radius of 2 inches or greater is maintained at all times. The verification shall be considered successful when inspection of the integrated rack fiber optic cable routing, installation and handling procedures shows that the cables are not bent in a tighter radius.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.3.2.4.5			

Appendix B Verification Definition Sheets

Number ME-006	Title MECHANICAL – ON-ORBIT OPERATIONAL ENVELOPE	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.1.1.1 Payload Attach System/Unpressurized Logistics Carrier Attach System On-Orbit Operational Envelope (I) 4.3.1.3.1.1.3 (A&B) Extravehicular Activity/Robotics Operational Envelope (I)			
Requirement Summary: Attached Payloads must meet ISS on-orbit operational envelopes.			
Detailed Descriptions of Requirements: Verification of the Payload Attach System (PAS)/Unpressurized Logistics Carrier Attach System (ULCAS) and Extravehicular Activity (EVA)/Extravehicular Robotics (EVR) operational envelopes shall be by inspection of the design drawings. The inspection of the design drawings shall show the following: 1). That the maximum dimensions of the attached payload fit within the envelope identified in SSP 570003, paragraph 3.1.3.1.1.1. 2). That the EVA translation corridor and accessibility is maintained between the Attached Payload and the other ISS equipment. 3). That the EVA translation corridor and accessibility is maintained around the operational/deployed attached payload and other ISS operations and installation/removal on adjacent PAS/ULCAS sites as specified in SSP 57003, paragraph 3.1.3.1.1.3.B Verification shall be considered successful when it is shown that the above operational envelope requirements are as specified in SSP 57003, paragraphs 3.1.3.1.1.1 and 3.1.3.1.1.3B.			
Required Verification Data: 1. Data Cert. Providing all exceedances identified to date for the on-orbit operational envelope 2. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-12 2. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: I	Hazard Report(s):
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.1.3.1.1.1 and 3.1.3.1.1.3			

Appendix B Verification Definition Sheets

Number ME-007	Title MECHANICAL – CLOSURES AND COVERS	Method A, I, A&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s):			
4.3.8.4.2.3 Holes (I)		4.3.8.4.2.6.2 Protective Covers or Guards (A&I)	
4.3.8.4.2.3.1 Handrails/Holds (I)		4.3.9.1.7.5 (A, G, H) Covers (A)	
4.3.8.4.2.4 Pinch Points (A&I)			
4.3.8.4.2.5 Protective Covers for Portable Equipment (A&I)			
Requirement Summary:			
To verify that closures, covers, pinch points and handrails/holds were designed properly and are provided for in design of the attached payload.			
Detailed Descriptions of Requirements:			
A. Covers shall be provided for holes that are round or slotted in the range of 10.0 to 25.0 mm (0.4 to 1.0 in.) (SSP 57003, paragraph 3.8.4.2.3) and that are in crewmember translation paths. An analysis shall be performed using data from drawings, integration documentation, and operational procedures to identify the applicable holes. Verification shall be performed by inspection of the design drawings to ensure that either proper hole sizes have been used or that all applicable holes are covered or guarded.			
B. Verification of attached payload pinch points and protective covers or guards shall be by analysis and inspection. An analysis shall be performed using data from drawings, integration documentation, and operational procedures to identify hardware pinch points and latches and similar devices and the required use of guards or covers due to location in the crewmember translation paths and maintenance work-sites. A drawing inspection shall show that the required cover installation has been accomplished or proper guards are in place. Verification shall be considered successful when the analysis and inspection shows that the all potential pinch points and latches and similar devices have been properly covered or guarded.			
C. Verification of attached payload protective covers for portable equipment shall be by analysis and inspection. An analysis shall be performed using data from drawings, integration documentation, and operational procedures to identify the required use of guards or covers for portable equipment. A drawing inspection shall show that the required cover installation has been accomplished or proper guards are in place. Verification shall be considered successful when the analysis and inspection shows that the all the necessary items have been properly covered or guarded.			
D. Verification of access covers, equipment housings, and inaccessible areas shall be performed by analysis. An analysis shall be performed using data from drawings, integration documentation, and operational procedures to verify that covers are provided for: 1). Areas where routine maintenance operations would otherwise require removing the entire case, cover, or dismantling an item of equipment, 2). Areas where equipment housings are provided with protective closures and covers for inaccessible areas, and 3). Where inaccessible areas are sealed to prevent any loose item from drifting into them.			

Appendix B Verification Definition Sheets

Number ME-007	Title MECHANICAL – CLOSURES AND COVERS	Method A, I, A&I	Hazard Report(s)
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A&I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.8.4.2.3, 3.8.4.2.3.1, 3.8.4.2.4, 3.8.4.2.5, 3.8.4.2.6.2, 3.9.1.7.5			

Appendix B Verification Definition Sheets

Number ME-008	Title MECHANICAL – BUILT-IN CONTROLS	Method A, I, A&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.2.2 Extravehicular Activity Actuated Controls (I) 4.3.8.4.2.9 Levers, Cranks, Hooks and Controls (A&I) 4.3.9.1.1.1E Manual Failure Detection, Isolation, and Recovery (A)			
Requirement Summary: Attached Payload EVA requirements for built-in controls.			
Detailed Descriptions of Requirements: Verification of the EVA actuated controls shall be by inspection. Verification will be successful when it is shown that there are no EVA actuated controls on Attached Payloads. Verification of levers, cranks, hooks, and controls shall be by analysis and inspection. An analysis shall be performed using data from drawings, integration documentation, and operational procedures to identify levers, cranks, hooks and controls and the required use of guards or covers due to location in crewmember translation paths and maintenance work-sites. A drawing inspection shall show that the required cover installation has been accomplished or proper guards are in place. Verification shall be considered successful when analysis and inspection shows that all levers, cranks, hooks, and controls have been properly covered, or guarded. Verification of manual failure, detection, isolation and recovery shall be by analysis using Hazard Analysis Reports, Reliability Block Diagram Analysis (RBDA), Failure Modes and Effects Analysis (FMEA), schematics, LSAR and software detailed design drawings. The verification shall be considered successful when the analysis shows that they are in accordance with SSP 57003, paragraph 3.9.1.1.1.E.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A&I	Hazard Report(s):
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.8.3.2.2, 3.8.4.2.9, 3.9.1.1.1			

Appendix B Verification Definition Sheets

Number ME-009	Title MECHANICAL – ROBOTIC CLEARANCE ENVELOPE	Method A & I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.2.3B Mass and Envelope Dimensions (I) 4.3.7.1E Equipment Requiring Shuttle Robotic Support (A) 4.3.7.3G External Equipment Requiring Space Station Remote Manipulator System Support (A) 4.3.7.3.1A Equipment Requiring SSRMS Support Using a NSTS Grapple Fixture (I) 4.3.7.3.2A Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (I) 4.3.7.4B External Equipment Requiring Dexterous Robotic Support (A&I) (*Inspection part only) 4.3.7.5A Equipment Requiring Robotic Translation (A&I) (*Inspection part only)			
Requirement Summary: Attached Payloads requiring Robotic support must meet the envelope requirements as specified.			
Detailed Descriptions of Requirements: <u>Mass and Envelope Dimensions</u> Verification shall be by inspection of design drawings to show that the attached payload on-orbit configuration translation envelope does not exceed the dimensions in SSP 42004, paragraph B3.2.2.1. <u>Equipment Requiring Shuttle Robotic Support</u> An Attached Payload requiring SRMS support shall be within the certified mass handling capacity of the SRMS in accordance with the payload mass noted in NSTS 21000–IDD–ISS, paragraph 14.1.5. <u>External Equipment Requiring Space Station Remote Manipulator System (SSRMS) support</u> Verification shall be by analysis. An analysis shall be performed to verify that an attached payload requiring SSRMS support, shields critical and hazardous components from contact with other objects during robotic operations. <u>Equipment Requiring SSRMS Support</u> Verification shall be by inspection of design drawings to show that an attached payload required SSRMS support provides a clearance envelope around the grapple fixture and/or the power data grapple fixture as specified in SSP 42004, paragraph I3.2.2.1.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A & I	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.1.2.3, 3.7.1, 3.7.3, 3.7.3.1, 3.7.3.2. SSP 42004, par. B3.2.2.1, I3.2.2.1			

Appendix B Verification Definition Sheets

Number ME-010	Title MECHANICAL – PAYLOAD PROTRUSIONS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.1.1.2 Interface Plane Protrusion (I)			
Requirement Summary: These requirements ensure that the Attached Payload does not interfere with the PAS/UCCAS.			
Detailed Descriptions of Requirements: Verification shall be by inspection of design drawings. The inspection shall show that the Attached Payload on orbit installed configuration does not include a keel pin, structure, mechanical, utility or ORU component that would extend into the PAS/UCCAS side of the interface plane. Verification shall be considered successful when the inspection shows that the Attached Payload installation does not include protrusions into the PAS/UCCAS side of the datum plane specified in SSP 57003, paragraph 3.1.3.1.1.2.			
Required Verification Data: 1. Preliminary Data Cert. providing drawings identifying all protrusions. 2. Updated Data Cert. providing drawings identifying all protrusions (if required).			Data Submittal Dates: 1. L-20 2. L-12
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Certificate of Compliance (COC)			Data Submittal Dates: I. N/A II. L-12
Applicable Document(s): SSP 57003, Par. 3.1.3.1.1.2			

Appendix B Verification Definition Sheets

Number ME-011	Title MECHANICAL – EQUIPMENT INSTALLATION	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.6.3 Incorrect Equipment Installation (A)			
Requirement Summary: Equipment must be labeled or marked to protect against improper installation and must not exceed maximum allowable dimensions.			
Detailed Descriptions of Requirements: Attached Payloads must provide features to preclude incorrect installation of equipment (i.e., guides, location pins, orientation marks, etc.). The verification shall be considered successful when the analysis shows that physical provisions have been incorporated to control the likelihood of an incorrect installation.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par., 3.9.1.6.3			

Appendix B Verification Definition Sheets

Number ME-012	Title MECHANICAL –Grapple Fixture Clearance Zone	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.1B Equipment Requiring Shuttle Robotic Support (I)			
Requirement Summary: These requirements define the grapple fixture clearances for Attached Payloads.			
Detailed Descriptions of Requirements: An inspection of flight drawings shall be performed to verify that Attached Payloads requiring SSRMS support provide a clearance zone from the Grapple Fixture centerline in accordance with NSTS 21000-IDD-ISS, paragraph 14.4.2.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): NSTS 21000-IDD-ISS, par. 14.4.2 SSP 57003, par. 3.7.1			

Appendix B Verification Definition Sheets

Number ME-013	Title MECHANICAL – ALIGNMENT	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.2.3B Passive Umbilical Mechanism Assembly (A) 4.3.8.3.1.1.1(A, B) Centering (A) 4.3.9.1.6.6.1 Direction of Removal (A) 4.3.9.1.6.6.2 Visibility (A)			
Requirement Summary: Attached Payload hardware shall be designed to allow proper alignment of payload hardware to the truss interface and proper alignment of crewmembers using handholds/rails.			
Detailed Descriptions of Requirements: Verification shall be considered successful when an analysis of the payload flight hardware drawings shows: <ul style="list-style-type: none"> The Attached Payload UMA configuration has provided the capability of achieving berthing with the contact conditions and misalignments consistent with truss interface as defined in SSP 57004, Figure 3.1.2.4-1. That there is a handrail/handhold provided less than 24 inches to the left or right of the body centerline when working in a foot restraint position as described in SSP 57003, Figure 3.8.1.1.1-1, and less than 18 inches above or below the center of the crewmember's optimum two-handed work envelope as described in SSP 57003, Figure 3.8.1.1.1-1 for a 50th percentile American female to 95th percentile American male anthropometric measurements. An Attached Payload ORU can be removable along a straight path. Forward edges of the payload equipment item are visible to the restrained crewmember during alignment and attachment. 			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.1.3.2.3, 3.8.3.1.1.1, 3.9.1.6.6.1, 3.9.1.6.6.2, Fig. 3.8.1.1.1-1 SSP 57004, Figure 3.1.2.4-1.			

Appendix B Verification Definition Sheets

Number ME-014	Title MECHANICAL – SCUFF PLATES	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.1J Equipment Requiring Shuttle Robotic Support (I) 4.3.7.3F External Equipment Requiring Space Station Manipulator System Support (I)			
Requirement Summary: Attached Payloads requiring SRMS and SSRMS support shall provide scuff plates.			
Detailed Descriptions of Requirements: An inspection of flight drawings shall be performed to verify scuff plates are provided and are in accordance with NSTS 21000-IDD-ISS, paragraph 3.1.1.2.2.2.2 and Figure 3.1.1.2.2.2-1. The verification shall be considered successful when the inspection shows compliance with the requirement as specified.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: I	Hazard Report(s):
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): NSTS 21000-IDD-ISS, par. 3.1.1.2.2.2.2, Figure 3.1.1.2.2.2-1. SSP 57003, par. 3.7.1 and 3.7.3			

Appendix B Verification Definition Sheets

Number ME-015	Title MECHANICAL – GRAPPLE FIXTURE LOCATION	Method A, I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.4.1.1 Grapple Fixture Locations (I) 4.3.1.4.1.2 Grapple Fixture Structural Support (A) 4.3.7.1 (C-D) Equipment Requiring Shuttle Robotic Support (I) 4.3.7.3K External Equipment Requiring Space Station Remote Manipulator System Support (I)			
Requirement Summary: Attached Payloads must ensure grapple fixture mounting and location is per requirements specified			
Detailed Descriptions of Requirements: <u>Grapple Fixture Locations</u> Verification that the Attached Payload Developer has accommodated grapple fixture locations shall be by inspection. The inspection shall be based upon documentation defining the required grapple fixture(s), the Attached Payload flight drawings, and locations defined in SSP 57004. An inspection of the Attached Payload flight drawings shall be performed to ensure that all grapple fixture interfaces are in accordance with SSP 30550, SSP 42004, and the location constraints defined in SSP 57004. The inspection shall be considered successful when the Attached Payload flight drawings document that all grapple fixtures are in accordance with SSP 30550, SSP 42004 and SSP 57004. <u>Grapple Fixture Structural Support</u> Verification shall be performed by analysis. An analysis shall be performed to verify that the Attached Payload structure production drawings accommodate grapple fixture supports in accordance with SSP 57003, section 3.7 and SSP 30559. <u>Equipment Requiring Shuttle Robotic Support or Space Station Remote Manipulator System Support</u> Verification that Attached Payloads, which are requiring Shuttle Remote Manipulator System (SRMS) support, accommodate grapple fixtures in accordance with NSTS 21000-IDD-ISS, paragraphs, 14.4.11, 14.4.12, and 14.4.3 shall be by inspection of the flight drawings. In addition, verification that Attached Payloads requiring SRMS and/or SSRMS support define the locations for the Grapple Fixture in SSP 57004 shall be by inspection.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method: A, I	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.1.4.1.1, 3.1.4.1.2, 3.7.1, 3.7.3. sec. 3.7 SSP 30550 SSP 30559 SSP 42004 SSP 57004 NSTS 21000-IDD-ISS, paragraphs, 14.4.11, 14.4.12, and 14.4.3			

Appendix B Verification Definition Sheets

Number ME-016	Title MECHANICAL - TOOLS	Method A, I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.4.1 Interface with NSTS Remote Manipulator System and Space Station Remote Manipulator System (A) 4.3.9.1.7.1 Extravehicular Activity Tools (I) 4.3.9.2.2.7 Standard On-Orbit Diagnostic Equipment (A)			
Requirement Summary: Attached Payloads requiring on-orbit maintenance must utilize manifested Space Station tools and diagnostic equipment.			
Detailed Descriptions of Requirements: <u>EVA Tools</u> Verification shall be by inspection of design drawings and test data. The Verification shall be considered successful when the inspection show that the Attached Payload is externally maintainable with the specified tools of SSP 30256. <u>Standard On-Orbit Diagnostic Equipment</u> The Verification shall be considered successful when the inspection show that the requirements have been met. Analysis shall be conducted using the LSAR maintenance planning resource reports. The verification shall be considered successful when the analysis proves that the LSAR on-orbit organizational maintenance tasks apply the allowable diagnostic tools listed in SSP 30256, Tables 3.2-1 and 3.2-2 or provide adequate physical constraint rationale for exceptions.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method: A	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.1.4.1, 3.9.1.7.1, 3.9.2.2.7 SSP 30256, Tables 3.2-1 and 3.2-2			

Appendix B Verification Definition Sheets

Number ME-017	Title MECHANICAL – CONNECTOR MATING/DEMATING	Method A, I, D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s):			
4.3.1.3.2.3A Passive Umbilical Mechanism Assembly (A)		4.3.9.1.7.3 Connectors (I)	
4.3.2.2.5.1.1 Mating/Demating of Power Connectors (A)		4.3.9.1.7.3.1.A One-Handed Operation (D)	
		4.3.9.1.7.3.2.A Mate/Demate (A)	
<p>Requirement Summary:</p> <p>These requirements ensure that electrical connectors can be operated easily by crewmembers on-orbit. The crew should be able to disconnect electrical connector plugs by a single turn, and internal connector plugs must provide a self-locking safety catch.</p>			
<p>Detailed Descriptions of Requirements:</p> <p><u>Passive Umbilical Mechanism Assembly</u></p> <p>Verification shall be by analysis. Verification shall be considered successful when the analysis shows that the Attached Payload UMA configuration has provided structural/mechanical interface to the PAS/UCCAS UMA part number 1F70162-1, or equivalent, to allow physical integration of the Attached Payload to the truss site.</p> <p><u>Mating/Demating of Power Connectors</u></p> <p>Verification that the Attached Payload equipment connected to Interface C meets the loss of power safety requirements specified in NSTS 1700.7 ISS Addendum shall be performed and submitted to the PSRP in accordance with NSTS 13830, Implementation Procedure for NSTS Payloads System Safety Requirements. Verification shall be considered successful when hazard reports and safety data presented to the PSRP during the phased safety reviews are approved.</p> <p><u>Connectors</u></p> <p>Verification shall be by inspection of the flight drawings to verify that the connectors conform to the design requirements in SSP 50005, paragraph 14.6.4.3.</p> <p><u>One-Handed Operation</u></p> <p>A demonstration shall be performed to verify that connectors can be mated/demated using only one hand.</p> <p><u>Mate/Demate</u></p> <p>Accessibility shall be verified by analysis. Verification shall be considered successful when an analysis of the payload flight hardware drawings shows that it is possible to mate/demate individual connectors without having to remove or mate/demate other connectors.</p>			
Required Verification Data:		Data Submittal Dates:	
1. Certificate of Compliance (COC).		1. L-6	
Description of Reverification Requirements:		Reverification Method:	Hazard Report(s):
		A or A&D	
<p>I. On-orbit relocation of the Attached Payload: No reverification required.</p> <p>II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.</p>			
Required Reverification Data:		Data Submittal Dates:	
I. N/A		I. N/A	
II. COC		II. L-6	
<p>Applicable Document(s):</p> <p>NSTS 1700.7 ISS Addendum</p> <p>NSTS 13830</p> <p>SSP 57003, par. 3.1.3.2.3, 3.2.2.5.1.1, 3.1.4.2, 3.9.1.7.3, 3.9.1.7.3.1, 3.9.1.7.3.2,</p> <p>SSP 50005, paragraph 14.6.4.3</p>			

Appendix B Verification Definition Sheets

Number ME-018	Title MECHANICAL – CONNECTOR ARRANGEMENT AND ACCESSIBILITY	Method I & D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.7.3.1B One-Handed Operation (D) 4.3.9.1.7.3.3 (A, B) Connector Arrangement (I) 4.3.7.3.2 (G) Equipment Requiring SSRMS Support Using 4.3.9.1.7.3.7.1 (A, B) Spacing (I) Power Data Grapple Fixture (I)			
Requirement Summary: Attached Payload connectors must be accessible, and they should be easy to disconnect, or reconnect without causing damage to them.			
Detailed Descriptions of Requirements: <ul style="list-style-type: none"> Attached Payloads requiring electrical interface with the SSRMS shall accommodate the PDGF harness and provide connectors in accordance with SSP 42004, section A3.2.2.4. Verification shall be considered successful when an inspection of the flight drawings shows compliance with the requirement. Space between connectors and adjacent obstructions shall be a minimum of 40 mm (1.6 inches) for EVA access. Verification shall be considered successful when an inspection of the space between connectors and adjacent obstructions shows compliance with the requirement. In addition, connector design and placement shall not preclude the use of either the right or the left hand. Verification of one-handed operation shall be by demonstration. Connectors in a single row or staggered rows which are removed sequentially by the crew (IVA) shall provide a minimum of 40 mm (1.6 inches) of clearance from other connectors and/or adjacent obstructions for 270 degrees of sweep around each connector beginning at the start of its removal/replacement sequence. Verification shall be considered successful when an inspection of connectors in a single row or staggered rows shows compliance with the requirements. Connector spacing shall be in accordance with SSP 50005, paragraph 11.10.3.6. If wing connectors are used, the minimum clearance between adjacent wing tabs shall be 2.5 inches. Verification shall be considered successful when an inspection of either the flight drawings or the hardware shows compliance with the requirements shown in SSP 57003, paragraph, 3.9.1.7.3.7.1. 			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I & D	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 42004, section A3.2.2.4 SSP 50005, par. 11.10.3.6. SSP 57003, par. 3.9.1.7.3.1, 3.9.1.7.3.3, 3.9.1.7.3.7.1, 3.7.3.2.			

Appendix B Verification Definition Sheets

Number ME-019	Title MECHANICAL – CONNECTOR PROTECTION AND SHAPE	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.7.3.2B Mate/Demate (A) 4.3.9.1.7.3.4 Connector Protection (A)			
Requirement Summary: Attached Payload connectors should be designed to prevent inadvertent reversing or mismatching of electrical connections. They should also have sufficient mechanical protection to prevent crewmember contact with exposed electrical contacts, and physical damage/contamination protection should be provided for demated connectors.			
Detailed Descriptions of Requirements: <u>Electrical Connectors</u> i. <u>Physical</u> - Protection shall be provided for all demated connectors against physical damage and contamination. Verification shall be considered successful when an analysis shows that protection is provided for all demated connectors against physical damage and contamination. ii. <u>Mate/Demate</u> – The design of Attached Payload connectors shall be verified by analysis. The analysis shall be performed by reviewing the payload hardware drawings to verify that it is possible to disconnect and reconnect electrical connectors and cable installations without damage to wiring connectors.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.9.1.7.3.2, 3.9.1.7.3.4			

Appendix B Verification Definition Sheets

Number ME-020	Title MECHANICAL – ALIGNMENT, CODING, AND ORIENTATION	Method A, I, &D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s):			
4.3.1.3.2.2 (A, B) Guide Pins (I, A)		4.3.9.1.7.3.5 (A, B) Coding (I)	
4.3.9.1.6.6.3 (A, B, C) Mounting Alignment (I)		4.3.9.1.7.3.7 Orientation (I)	
4.3.9.1.7.2 (A, B) Payload Hardware and Equipment Mounting (D&I)		4.3.9.1.7.6.4 Fastener Access Holes (I)	
Requirement Summary: Parts that are to be mated on-orbit must have alignment marks with both halves properly coded, and grouped plugs must be oriented so that aligning pins are in the same relative position.			
Detailed Descriptions of Requirements:			
A. Alignment marks, guide pins, or mating parts shall be verified by inspection. Examining the mating hardware for alignment marks or guide pins in a visible location during mating shall performed by inspection. Verification shall be considered successful when an inspection shows that the alignment marks or guide pins are applied to mating parts and consist of a straight or curved line to a width and length sufficient to allow accurate alignment. Guide pins shall be verified by inspection of the drawings or the hardware. The verification shall be considered successful when the guide pins are shown to extend beyond the plugs electrical pins to ensure that the guide is obtained before the electrical pins engage.			
B. Both halves of mating connectors shall display a code or identifier which is unique to that connection. The labels or codes on connectors shall be located so that they are visible when connected or disconnected. Verification shall be considered successful when an inspection shows that both halves of mating connectors display a code or identifier which is unique to that connection.			
C. Grouped plugs and receptacles shall be oriented so that the aligning pins or equivalent devices are in the same relative position. Verification shall be considered successful when an analysis of the payload flight hardware drawings shows that grouped plugs and receptacles are oriented so that the aligning pins or equivalent devices are in the same relative position.			
D. Access holes for fasteners shall be verified by inspection. Verification shall be considered successful when an inspection shows that covers or shields through which mounting fasteners must pass for alignment to the basic chassis of the unit shall have holes for passage of the fastener without precise alignment (and hand or necessary tool if either is required to replace).			
E. Payload hardware and equipment mounting shall be verified by demonstration and inspection. The verification shall be considered successful when it is shown that the payload hardware is designed, labeled, or marked to prevent improper installation.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A, I, & D	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required.			
II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			

Appendix B Verification Definition Sheets

Number ME-020	Title MECHANICAL – ALIGNMENT, CODING, AND ORIENTATION	Method A, I, &D	Hazard Report(s)
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.1.3.2.2, 3.9.1.6.6.3, 3.9.1.7.2, 3.9.1.7.3.5, 3.9.1.7.3.7, 3.9.1.7.6.4			

Appendix B Verification Definition Sheets

Number ME-021	Title MECHANICAL – PHYSICAL INTERFERENCE	Method I, A & D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s):			
4.3.7.3D External Equipment Requiring Space Station Remote Manipulator System Support (I)		4.3.8.2.2 Extravehicular Activity Translation Corridor Protrusion (A & I)	
4.3.7.4 (A&E) External Equipment Requiring Dexterous Robotic Support (I)		4.3.8.4.2 Equipment Clearance for Entrapment Hazards (A & D)	
		4.3.8.3.3.1.3B Mounted Clearance (A or D)	
Requirement Summary: Attached Payloads must have adequate volume and clearances such that they provide sufficient access to equipment during on-orbit installation, operations, and maintenance.			
Detailed Descriptions of Requirements: <u>External Equipment Requiring SSRMS Support</u> An Attached Payload requiring SSRMS support and not using the SSRMS programmable force/moment accommodation capability, shall provide capture, berthing, and closure drive capability to overcome the backdrive thresholds (static friction) defined in SSP 57003 table 3.7.3–3 and complete the closure of the capture and berthing operation when the SSRMS is limp per Note (1) of the table. The verification shall be considered successful when the analysis shows compliance with the requirement as specified.			
<u>External Equipment Requiring Dexterous Robotic Support</u> A. The verification shall be considered successful when the inspection and analysis show an Attached Payload requiring dexterous robot support provides a dexterous handling interface in accordance with SSP 42004, section C3.2 (excluding 3.2.2.3.3), for Standard Dexterous Grasp Fixture (SDGF), on paragraphs within D3.2 for Micro–conical Fitting (MCF), or paragraph within G3.2 for bare bolt interfaces, or paragraphs within H3.2 (excluding 3.2.2.3.3), for Modified Micro–Fixtures or paragraphs within K3.2 for Modified MCFs. B. An inspection of flight element drawings shall be performed to verify that the equipment requiring temporary storage on the dexterous robot is as defined in SSP 42004, Section E.			
<u>EVA Translation Corridor Protrusion</u> The inspection shall be based on models and drawings of the on orbit PAS/UCCAS installed Attach Payload. An analysis shall be performed to ensure that in the event of a translation corridor protrusion, appropriate fixtures are provided to maintain intended function. The verification shall be considered successful when the on orbit installed Attached Payload configuration allows for EVA translation in accordance with SSP 50005.			
<u>Equipment Clearance for Entrapment Hazards</u> An analysis shall be performed using data from drawings, operational procedures, and integration documentation to identify equipment/hardware that may require removal or replacement or both and the planned stowage associated with maintenance operations. Demonstrations shall show that stowage capacity and locations for equipment/hardware used in the maintenance procedures are sufficient to prevent the creation of a crew entrapment hazard. Verification shall be considered successful when demonstrations show that maintenance activities will not require stowage of material in a manner that obstructs crewmember translation or creates an entrapment area.			
<u>Mounted Clearance</u> An analysis or demonstration of the flight hardware shall be performed to verify handle and grasp areas are located so that they do not interfere with equipment location or maintenance. The verification shall be considered successful when the analysis or demonstration confirms compliance with the requirement specified in SSP 57003 par. 3.8.3.3.1.3 B.			

Appendix B Verification Definition Sheets

Number ME-021	Title MECHANICAL – PHYSICAL INTERFERENCE	Method I, A & D	Hazard Report(s)
Required Verification Data: 1. Certificate of Compliance (COC).			
Description of Reverification Requirements:		Reverification Method: I, A & D	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.7.3, 3.7.4, 3.8.2.2, 3.8.4.2, 3.8.3.3.1.3, table 3.7.3–3 SSP 50005 SSP 42004, Section E, C3.2, D3.2, G3.2, H3.2, K3.2			

Appendix B Verification Definition Sheets

Number ME-022	Title MECHANICAL – HOSE/CABLE RESTRAINTS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.7.4 (A, B, C, D) Cable Restraints (I)			
Requirement Summary: These requirements ensure that hoses and cables are adequately restrained.			
Detailed Descriptions of Requirements: Hose/Cable restraints shall be verified by inspection. Verification shall be considered successful when an inspection of the flight hardware shows that the loose ends of hoses and cables have a means of being restrained; that conductors, bundles, or cables are secured by a means of clamps unless they are contained in wiring ducts or cable retractors and that loose cables are restrained as specified in SSP 57003, paragraph 3.9.1.7.4.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: N/A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. N/A			Data Submittal Dates: I. N/A II. N/A
Applicable Document(s): SSP 57003, par. 3.9.1.7.4			

Appendix B Verification Definition Sheets

Number ME-023	Title MECHANICAL – ENGAGEMENT STATUS INDICATION	Method I, A or D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.3E External Equipment Requiring Space Station Remote Manipulator System Support (A or D) 4.3.9.1.7.3.3.1 Status (D) 4.3.9.1.7.5C Covers (A) 4.3.9.1.7.6.1(A, B) Engagement Status Indication (I) 4.3.7.1N Equipment Requiring Shuttle Robotic Support (A or D)			
Requirement Summary: Attached Payloads shall provide indication on mating status for connectors, closures and fasteners			
Detailed Descriptions of Requirements: The demonstration shall show that connector mating status can be determined. The verification shall be considered successful when a method exists to determine connector mating status. The verification shall be considered successful when the analysis shows that closures have a positive means of indicating that it is locked. Verification shall be considered successful if the inspection shows that EVA actuated fasteners/devices are visually accessible to ensure proper seating or restraint in stowed or installed locations and provide indication of correct engagement.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: I, A or D	Hazard Report(s):
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.7.1.3.7.3, 3.9.1.7.3.3.1, 3.9.1.7.5, 3.9.1.7.6.1			

Appendix B Verification Definition Sheets

Number ME-024	Title MECHANICAL – MOUNTING BOLT/FASTENER SPACING AND TOOL CLEARANCE	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.7.1.1 (A, B, C) Tool Clearance (I) 4.3.9.1.7.6.3 (A, B, C) Fastener Clearances (I) 4.3.9.2.2.6.1 Extravehicular Activity Access to Fasteners (I)			
Requirement Summary: Spacing around fasteners must allow hand or tool access.			
Detailed Descriptions of Requirements: Verification shall be by inspection of design drawings and test data. Verification shall be considered successful when: <ol style="list-style-type: none"> The data shows that the attached payload equipment and structures surrounding bolts requiring EVA ratcheting shall protect a 90 degree throw angle and shall allow right or left handed operation. The data shows that the attached payload structure surrounding tool actuated fasteners provides the proper clearance as shown in SSP 57003, Figure 3.9.1.7.1.1–1. The data shows that the attached payload for tool head clearance as defined in SSP 57003, Figure 3.9.1.7.1.1–1. <p>Fastener clearances shall be verified by inspection. Verification shall be considered successful when:</p> <ol style="list-style-type: none"> An inspection shows that tool clearances are as specified in SSP 57003, paragraph 3.9.1.7.6.3. An inspection shows EVA fasteners are separated to provide clearances in accordance with SSP 50005, figure 14.6.2.3. An inspection shows that the clearances are as specified for fasteners recessed in a robotic interface. <p>An inspection shall be performed to ensure that all recessed robotics compatible EVA fasteners provide clearance between the outer edge of the fastener and the robotics interface so that the drive end of a standard tool can be inserted, actuated, and removed. The inspection shall be considered successful when the Attached Payload and component drawings document that for each recessed robotics compatible EVA fasteners, clearance between the fastener outer edge and robotics interface have been provided.</p>			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I & A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.9.1.7.1.1, 3.9.1.7.6.3, 3.9.2.2.6.3, Figure 3.9.1.7.1.1–1 SSP 50005, Figure 14.6.2.3			

Appendix B Verification Definition Sheets

Number ME-025	Title MECHANICAL – FASTENERS	Method A, I, T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.4.2.7.1 Screws and Bolts (A) 4.3.9.1.7.6.5 (A, B) Captive Fasteners (A) 4.3.8.4.2.7.2 Securing Pins (A) 4.3.9.1.7.6.6 (A, B) Quick Release Fasteners (I) 4.3.8.4.2.8 Safety Critical Fasteners (T) 4.3.9.1.7.6.9 (A, B) Contingency Override (I) 4.3.9.1.7.6 Fasteners (I)			
Requirement Summary: These requirements ensure that fasteners in the Attached Payload comply with specified operational requirements.			
Detailed Descriptions of Requirements: All fasteners shall be captive when disengaged. (SSP 57003, paragraph 3.9.1.7.6.5) Verification shall be considered successful when an analysis shows that fasteners that are planned to be installed and/or removed on-orbit are captive when disengaged. Quick Release Fasteners shall require a maximum of one complete turn to operate (quarter-turn fasteners are preferred SSP 57003, paragraph 3.9.1.7.6.6) and be positive-locking in the open and closed positions (SSP 57003, paragraph 3.9.1.7.6.6). Verification shall be considered successful when an inspection shows that fasteners are positive-locking in open and closed positions. Threaded fasteners shall have only right-hand threads. (SSP 57003, paragraph 3.9.1.7.6) Verification shall be considered successful when an inspection shows that threaded fasteners have right-handed threads per the hardware or drawings as specified in SSP 52005, section 5.6. Threaded ends of screws and bolts accessible by the crew and extending more than 3.0 mm (0.12 in.) shall be capped to protect against sharp threads. (SSP 57003, paragraph 4.3.8.4.2.7.1) To satisfy the verification an analysis shall be performed using data from drawings, integration documentation, and operational procedures to identify screws and bolts that exceed the length specified in the requirements and the required use of guards or covers due to location in crewmember translation paths and maintenance worksites. The verification shall be considered successful when a drawing inspection shows that screws and bolts which exceed the specified length have been properly covered, or guarded.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A, I, T	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 52005, section 5.6 SSP 57003, par. 3.8.4.2.7.1, 3.8.4.2.7.2, 3.8.4.2.8, 3.9.1.7.6, 3.9.1.7.6.5, 3.9.1.7.6.6, 3.9.1.7.6.9			

Appendix B Verification Definition Sheets

Number ME-026	Title MECHANICAL – LATCHES	Method I, A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.4.2.6.1 (A, B, C, D, E) Design (A) 4.3.9.1.7.6.7 (A, B, C) Over Center Latches (I)			
Requirement Summary: These requirements ensure that latches and associated handles/operating mechanisms in the Attached Payload comply with specified operational requirements.			
Detailed Descriptions of Requirements: Over center latches shall have the following design features: <ul style="list-style-type: none"> • <u>Nonself-Latching</u> – Over center latches shall include a provision to prevent undesired latch element realignment, interface, or re-engagement. (SSP 57003, paragraph 3.9.1.7.6.7). Verification shall be considered successful when an inspection shows that there is a provision to protect against undesired latch element realignment, interface, or re-engagement. • <u>Latch Lock</u> – Latch catches shall have locking features. (SSP 57003, paragraph 3.9.1.7.6.7). Verification shall be considered successful when an inspection shows that latch catches have locking features. • <u>Latch Handles</u> – If the latch has a handle, the latch handle and latch release shall be operable by one hand. (SSP 57003, paragraph 3.9.1.7.6.7). Verification shall be considered successful when an inspection shows that the latch handle and latch release are operable by one hand. <p>Latches that pivot, retract, or flex so that a gap of less than 35 mm (1.4 in.) exists shall be designed to prevent entrapment of a crewmembers appendage. (SSP 57003, paragraph 3.8.4.2.6.1). Verification shall be considered successful when an inspection shows that all latches and similar devices have been properly covered, or guarded and designed to prevent entrapment of crewmember appendages.</p>			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.8.4.2.6.1, 3.9.1.7.6.7			

Appendix B Verification Definition Sheets

Number ME-027	Title MECHANICAL – FASTENER HEAD TYPE	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.7.6.8 (A, B) Fastener Heads and Knobs (I)			
Requirement Summary: These requirements ensure that fastener head designs comply with operational requirements.			
Detailed Descriptions of Requirements: A. Fastener head type shall be verified by inspection. Verification shall be considered successful when an inspection shows that the fastener and knobs for suited gloved hand operations have a minimum head diameter of 1.5 inches and a maximum diameter of 2 inches. B. Fastener head height shall be verified by inspection. Verification shall be considered successful when an inspection shows that the fastener head height minimum is 0.75 inches.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.9.1.7.6.8			

Appendix B Verification Definition Sheets

Number ME-028	Title MECHANICAL – ONE-HANDED FASTENER ACTUATION	Method A, D, A or D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.3.1.5B Non-Fixed Handles Design (A or D) 4.3.9.1.6.1 Method (A) 4.3.9.1.7.6.2 One-Handed Actuation (D)			
Requirement Summary: One-handed operation (either left or right hand) should be sufficient to actuate fasteners.			
Detailed Descriptions of Requirements: One-handed actuation shall be verified by analysis or demonstration. The analysis or demonstration shall be performed on the drawings, flight hardware, or hardware which replicates the flight hardware configuration. Verification shall be considered successful when the analysis or demonstration shows that fasteners planned to be removed or installed on-orbit can be mated/demated using only one hand, which does not preclude the use of either hand.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A or D	Hazard Report(s):
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.8.3.3.1.5, 3.9.1.6.1, 3.9.1.7.6.2			

Appendix B Verification Definition Sheets

Number	Title	Method	Hazard Report(s)
ME-029	MECHANICAL – ACCIDENTAL ACTUATION PROTECTION	I, A	
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.2.5 Safety Interlocks (A) 4.3.9.1.7.7.1B Contingency Extravehicular Activity Controls (I)			
Requirement Summary: These requirements protect against accidental actuation of switches or other control devices.			
Detailed Descriptions of Requirements: Verification shall be by inspection of design drawings. Verification shall be considered successful when the inspection shows that the Attached Payload conforms to the requirements in SSP 50005, paragraph 9.2 and provides tactile and/or visual indication of position of actuated switches and provides protection of controls from inadvertent actuation. Verification shall be by analysis. An analysis shall be performed using data from drawings, software requirements/implementation documentation, hazard analyses, and ICDs to identify hazardous operations during maintenance and the implementation of related safety interlocks. The verification shall be considered successful when it has been shown that installed interlocks provide the necessary inhibit functions for all identified hazards during maintenance.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.1.3.2.5, and 3.9.1.7.7.1 SSP 50005, par. 9.2			

Appendix B Verification Definition Sheets

Number ME-030	Title MECHANICAL – POSITION INDICATION	Method I, A or D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.3.1.5C Non-Fixed Handles Design (A or D) 4.3.9.1.7.7.1A Contingency Extravehicular Activity Controls (I)			
Requirement Summary: The position of switches or handles should be clearly evident.			
Detailed Descriptions of Requirements: Verification shall be by inspection of design drawings. Verification shall be considered successful when the inspection shows that the Attached Payload conforms to the requirements in SSP 50005, paragraph 9.2 and provides tactile and/or visual indication of position of actuated switches. An analysis or demonstration shall confirm that the stop position for holding the handle perpendicular to the surface on which it is mounted is in compliance with the requirement specified in SSP 57003, paragraph 3.8.3.3.1.5 A.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.8.3.3.1.5, 3.9.1.7.7.1 SSP 50005, par. 9.2			

Appendix B Verification Definition Sheets

Number ME-031	Title MECHANICAL – TETHER ATTACH POINTS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.3.2.1 (A, B, C) Tether Attachment Points (I)			
Requirement Summary: Attached Payloads shall provide safety tether points.			
Detailed Descriptions of Requirements: An inspection of Attached Payload hardware and flight drawings shall be performed to verify that crew safety tether points have been provided. Also, that crew safety tether points have been provided on the interfacing surface which the item is to be secured and that crew safety tether points have been designed in accordance with SSP 57003, paragraph 3.8.3.3.2.1.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.8.3.3.2.1			

Appendix B Verification Definition Sheets

Number ME-032	Title MECHANICAL – RESTRAINT AND MOBILITY AIDS	Method A, D, I, A&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.3 Mobility Aids and Restraints (I) 4.3.9.1.5 Access Item Retainment (A & I) 4.3.8.3.3.1.6 Handrails/Handhold Tether Attachment (I) 4.3.9.1.7.3.4.1 Protecting Caps (I) 4.3.8.3.3.2 EVA Safety Tethers and Safety Hooks (I) 4.3.9.1.7.5F Covers (A) 4.3.8.4.2.7 Captive Parts (D) 4.3.9.2.2 (A,B) On-Orbit Maintenance (A) 4.3.8.4.2.7.3 Locking Wires (A)			
Requirement Summary: Attached Payloads should be designed and built such that any crewmember, while using restraints and mobility aids, is able to perform installation, operation, and maintenance.			
Detailed Descriptions of Requirements: <u>Mobility Aids and Restraints</u> Verification shall be by inspection. Inspection of Attached Payload drawings shall include mobility aids and restraints. Verification shall be considered successful when the Attached Payload is in accordance with the requirements specified in SSP 50005, paragraph 11.8 <u>Handrails/Handhold Tether Attachment/EVA Safety Tethers and Safety Hooks</u> An inspection of payload hardware and flight drawings shall be performed to verify that handrails/handholds accommodate safety tether hooks and that tethers are identified along all routes and at all work-sites as defined in SSP 57003, paragraph 3.8.3.3.1.6 and 3.8.3.3.2.1. <u>Captive Parts/Lockwire/Protective Caps</u> Verification shall be by demonstration to show that unrestrained parts that may be temporarily removed on-orbit will be held captive. Verification shall be considered successful when it is demonstrated that all unrestrained parts that may be temporarily removed on-orbit are tethered or otherwise held captive. In addition, all protective caps shall be verified via inspection of flight drawings to show that each cap is tethered. <u>Access Item Retainment/Covers</u> Verification shall be by analysis and inspection. An analysis shall be performed using the engineering design drawings and data obtained from neutral buoyancy and 1-g development testing. The inspection of design drawings shall show that the design incorporates restraining provisions for removable items based on the analysis. The verification shall be considered successful when the analysis, test data, and inspections show that the covers, caps, and other structural parts, removed to gain access for a planned maintenance task, are capable of being retained clear of the work-site working volume. In addition, an analysis as to whether or not covers that are completely removable are self-supporting shall be performed. <u>On-Orbit Maintenance</u> An analysis of engineering design drawings shall be performed to verify that personnel and equipment mobility aids and restraining devices are provided to support on-orbit maintenance. The verification shall be considered successful when the analysis proves that these devices have been incorporated in the system design for planned on-orbit maintenance. An analysis shall also be conducted using the FMEA, ORU selection rationale, and preventive maintenance analysis. The verification shall be considered successful when the analysis proves that the selected LSAR on-orbit maintenance tasks comply with the ORU selection criteria, rectify the projected failure modes, satisfy preventive maintenance restrictions, and apply the allowable tools listed in Tables 3.2-1 and 3.2-2 of SSP 30256:001 or provide adequate physical constraint rationale for exceptions.			

Appendix B Verification Definition Sheets

Number ME-032	Title MECHANICAL – RESTRAINT AND MOBILITY AIDS	Method A, D, I, A&I	Hazard Report(s)
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A or D	Hazard Report(s):
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 30256, Tables 3.2-1 and 3.2-2 SSP 57003, par. 3.8.3.3, 3.8.3.3.1.6, 3.8.3.3.2, 3.8.3.3.2.1, 3.8.4.2.7, 3.8.4.2.7.3, 3.9.1.5, 3.9.1.7.3.4.1, 3.9.1.7.5, 3.9.2.2 SSP 50005, paragraph 11.8			

Appendix B Verification Definition Sheets

Number ME-033	Title MECHANICAL – CAPTIVE PARTS	Method D&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.5.1 Captive Parts (D & I)			
Requirement Summary: Attached Payloads must provide captive parts.			
Detailed Descriptions of Requirements: A demonstration or inspection of the Attached Payload shall verify that a means (i.e., hinges, tethers, etc.) to retain access covers, caps, and other structural parts, that require on-orbit maintenance or other planned activities, clear of the worksite working volume in accordance with SSP 50005. Verification shall be considered successful when a demonstration and inspection shows that all unrestrained parts that are temporarily removed on orbit are held captive.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: D&I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.9.1.5.1 SSP 50005			

Appendix B Verification Definition Sheets

Number ME-034	Title MECHANICAL – HANDLES	Method A or D, A, I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.3.1 Provide Extravehicular Activity Handles (I) 4.3.8.3.3.1.3 (A, C) Mounted Clearance (A or D) 4.3.8.3.3.1.1 (A,B) Extravehicular Activity Handholds/Handrails (A) 4.3.8.3.3.1.4B Positioning/Location (A or D) 4.3.8.3.3.1.2 Dimensions (A or D)			
Requirement Summary: These requirements ensure that removable or portable payload units provide handles or other suitable means for grasping them (if required) and that the handles/grasping means satisfy specified design requirements.			
Detailed Descriptions of Requirements: <u>Extravehicular Activity (EVA) Handles</u> Provision of handles on portable payload units shall be verified by inspection of equipment drawings. Verification shall be considered successful when inspection of the portable unit hardware confirms compliance with the requirements. <u>EVA Handholds/Handrails</u> Handrail/handhold orientation shall be verified by analysis. The analysis shall be considered successful when the Attached Payload flight drawings show that handrail/handholds are provided in accordance to SSP 32056:001, paragraph 3.6.1 and SSP 57003 par. 4.3.8.3.3.1.1B. <u>Dimensions</u> EVA handle dimensions for moveable or portable units shall be verified by analysis or demonstration. The verification shall be considered successful when demonstration of the flight hardware confirms compliance with the requirements in SSP 57003, paragraph 3.8.3.3.1.2. <u>Mounted Clearance</u> EVA clearances between the low surface of the handrail/handhold and the mounting surface shall be verified by analysis or demonstration. The verification shall be considered successful when the analysis or demonstration of the flight hardware confirms compliance with the requirements in SSP 57003, paragraph 3.8.3.3.1.3 A. EVA clearances consistent with gloved hand sizes shall be verified by analysis or demonstration. The verification shall be considered successful when the analysis or demonstration of the flight hardware confirms compliance with the requirements in SSP 57003, paragraph 3.8.3.3.1.3 C. <u>Positioning/Location</u> An analysis or demonstration of the flight hardware shall be performed to verify these requirements. The verification shall be considered successful when the analysis or demonstration confirms that the handles and grasp areas are placed on the accessible surface of an item consistent with the removal direction in compliance with the requirement specified in SSP 57003, paragraph 3.8.3.3.1.4 B.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A&D&I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6

Appendix B Verification Definition Sheets

Number	Title	Method	Hazard Report(s)
ME-034	MECHANICAL – HANDLES	A or D, A, I	
Applicable Document(s): SSP 32056, paragraph 3.6.1 SSP 57003, par. 3.8.3.3.1, 3.8.3.3.1.1, 3.8.3.3.1.2, 3.8.3.3.1.3, 3.8.3.3.1.4, 3.8.4.2.3.1, 4.3.8.3.3.1.1B			

Appendix B Verification Definition Sheets

Number ME-035	Title MECHANICAL – LABELING FUNCTIONAL CONSIDERATIONS AND PAYLOAD ORIENTATION	Method A or D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.3.1.4C Positioning/Location (A or D)			
Requirement Summary: Labels, decals, and placards on Attached Payloads must be properly oriented.			
Detailed Descriptions of Requirements: An analysis or demonstration of the flight hardware shall be performed to verify that the mobility handholds located within 3 ft of an Attached Payload or ISS equipment, and poses a critical or catastrophic hazard to the crew member or the equipment, is identified and color coded.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A or D	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.8.3.3.1.4			

Appendix B Verification Definition Sheets

Number ME-036	Title MECHANICAL – INTERCHANGEABILITY	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.1.5 Interchangeability (A)			
Requirement Summary: The AP design must be compatible with any of the six truss sites.			
Detailed Descriptions of Requirements: An analysis shall be performed using design drawings to verify that the hardware configuration is compatible with installation on any of the six truss sites. The verification shall be considered successful when the analysis confirms that the AP is compatible with the six sites.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003 par. 3.1.1.5			

Appendix B Verification Definition Sheets

Number ME-037	Title MECHANICAL – LABELING DESIGN	Method A, I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): <div style="display: flex; justify-content: space-between;"> 4.3.8.3.3.1.7 Danger Warnings (I) 4.3.9.1.7.7.3 Labeling (I) </div> <div style="display: flex; justify-content: space-between;"> 4.3.8.3.5 Location Coding (A) 4.3.10 (A, B) Nameplates and Product Marking (I & A) </div> <div style="display: flex; justify-content: space-between;"> 4.3.9.1.7.3.6 Pin Identification (I) </div>			
Requirement Summary: Decals, placards, and labels for payloads must satisfy specific criteria.			
Detailed Descriptions of Requirements:			
<u>Danger Warnings</u> An inspection of Attached Payload hardware and flight drawings shall be performed to verify this requirement. The verification shall be considered successful when the inspections show that translation and mobility handholds located within 3 ft. of payload equipment which poses a critical or catastrophic hazard to the crewmember or to the equipment are identified and color coded.			
<u>Location Coding</u> The Attached Payload location coding scheme shall be analyzed to verify that it is a single, consistent alphanumeric operational coding standard for designating locations across the truss in accordance with SSP 30575. The verification shall be considered successful when it is shown that there is a single, consistent operational coding standard in accordance with SSP 30575.			
<u>Pin Identification</u> Pin identification shall be verified by inspection. Verification shall be considered successful when an inspection shows that each electrical plug and electrical receptacle is identified either on the plug or receptacle or on any accompanying chart.			
<u>Labeling</u> Verification shall be by inspection of design drawings. Verification shall be considered successful when the inspection shows that the Attached Payload labeling and color coding conforms to the requirements in SSP 50005, Section 9.			
<u>Nameplates and Product Marking</u> Labels on integrated Attached Payload, all (installed in the Attached Payload or separately), Attached Payload elements, loose equipment, consumables, ORUs, crew accessible connector and cables, switches, indicators, and controls shall be verified by inspection. The inspection shall be of the FCSD approval documentation. The verification shall be considered successful when integrated Attached Payloads, all (installed in the Attached Payload or separately) Attached Payload elements, loose equipment, consumables, ORUs, crew accessible connectors and cables, switches, indicators, and controls have been shown to have FCSD approved labels. The instructions for FCSD to follow in granting approval of labels are located in SSP 57003, Appendix C. In addition, an analysis of engineering design drawings shall be performed to verify that marking techniques shall not degrade the structural integrity of the equipment. The verification shall be considered successful when the analysis proves that the requirements have been satisfied.			
Required Verification Data: 1. Drawings showing the size and location of the caution and warning labels. 2. Certificate of Compliance (COC) showing FCSD approval.			Data Submittal Dates: 1. L-12 2. L-6

Appendix B Verification Definition Sheets

Number ME-037	Title MECHANICAL – LABELING DESIGN	Method A, I	Hazard Report(s)
Description of Reverification Requirements:		Reverification Method: A, I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.			Data Submittal Dates: I. N/A II. Same as the original submittal dates
Applicable Document(s): SSP 30575 SSP 50005, Section 9 SSP 57003, par. 3.8.3.3.1.7, 3.8.3.5, 3.9.1.7.3.6, 3.9.1.7.7.3, 3.10, and Appendix C			

Appendix B Verification Definition Sheets

Number ME-038	Title MECHANICAL – ACCESSIBILITY	Method I, D, & A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.2.1 Payload Attach System/Unpressurized Cargo Carrier Attach System Interface Clearances (I) 4.3.8.3.1 Crew Access Dimensions (D) 4.3.8.3.1.1 Body Envelope and Reach Accessibility (D) 4.3.8.3.1.1.3 External Task Location Requirements (D) 4.3.8.3.1.4A Positioning/Location (A or D) 4.3.8.3.4.1 Extravehicular Activity Gloved Hand Access (A or D)			
4.3.9.1.3(A, B, C, D) Access (I & A) 4.3.9.1.6.2 Equipment Item Interconnection Devices (A) 4.3.9.1.6.7.1 Capture Latch Assembly & Umbilical Mechanical Assembly EVA Override (A) 4.3.9.1.6.7.2 Payload Attach System and Unpressurized Cargo Carrier Attach System Orbital Replacement Unit Extravehicular Activity Maintenance(A) 4.3.9.1.7.5E Covers (A) 4.3.9.2.2.6 Access For On-Orbit Maintenance (A)			
Requirement Summary: Inspection or replacement of an item should be possible without requiring the removal of another ORU or the removal of more than one access cover.			
Detailed Descriptions of Requirements: <u>PAS/UCCAS Interface Clearances:</u> An inspection of the design and installation drawings shall be performed to verify that the Attached Payload does not violate the EVA access envelopes as defined in SSP 57003, paragraph 3.1.3.1.1.3A <u>Crew Access Dimensions/ Body Envelope and Reach Accessibility</u> Payload hardware accessibility shall be verified by demonstration. The verification shall be considered successful when the demonstration shows that the specified accessibility is sufficient to remove, replace, operate and maintain integrated Attached Payload equipment. <u>Positioning/Location</u> An analysis or demonstration of the flight hardware shall be performed to verify that translation and mobility handholds shall be positioned such that crew-operated equipment is accessible and not obstructed visually or physically by the handholds. <u>EVA Glove Hand Access</u> Verification shall be by analysis or demonstration. Equipment drawings for items that require gloved hand operations shall be analyzed to verify clearance in accordance with SSP 57003, Figure 3.8.3.4.1-1. Verification shall be considered successful when dimensional analysis or demonstration of the design shows compliance with the requirements. <u>External Task Location Requirements</u> All pressurized suit task locations shall be verified by demonstration. Verification shall be considered successful when the demonstration shows that the specified EVA tasks are located per SSP 57003, Figure 3.8.3.1.1.3-1. <u>Access</u> Verification shall be by inspection and analysis of flight drawings. The inspection and analysis shall show the following: 1). Access clearance in accordance with SSP 57003, Figure 3.8.3.1.1.1-1 shows that the Attached Payload provides access to inspect or replace an ORU without removal of another ORU or more than one access cover, 3). Shows that the Attached Payload provides EVA access to remove and replace an ORU in accordance with SSP 50005, paragraphs 14.3.2.3.1 and 14.4.3, and 4). When the Attached Payload meets the requirements defined in SSP 57003, paragraph 3.9.1.3.D. <u>Equipment Item Interconnection Devices</u> An analysis shall be performed using equipment/installation drawings, maintenance procedures contained in the LSAR,			

Appendix B Verification Definition Sheets

Number ME-038	Title MECHANICAL – ACCESSIBILITY	Method I, D, & A	Hazard Report(s)
<p>maintainability analysis and data obtained from neutral buoyancy and 1-g development testing, and hardware integration testing. The verification shall be considered successful when the analysis proves that utility line attachment/mounting has been provided for maintenance.</p> <p><u>Capture Latch Assembly & Umbilical Mechanism Assembly Extravehicular Activity Override and Payload Attach System Orbital Replacement Unit Extravehicular Activity Maintenance.</u></p> <p>Verification shall be by analysis. Verification shall be considered successful when an analysis of the Attached Payload flight drawings (on-orbit configuration) shows that EVA access for CLA & UMA override and PAS & UCCASS ORU (CLA, UMA, & Guide Vane) maintenance has been provided in accordance with SSP 30256 and SSP 50005, respectively.</p> <p><u>Covers</u></p> <p>An analysis of payload hardware and flight drawings shall be performed to verify that bulkheads, brackets, and other units shall not interfere with removal or opening of covers. The verification shall be considered successful when the analysis shows that other units do not interfere with removal or opening of covers.</p> <p><u>Access for On-Orbit Maintenance</u></p> <p>Analysis shall be conducted using the FMEA, ORU selection, preventive maintenance analysis, development program test results, and program defined crew time allocations. The verification shall be considered successful when the analysis proves that LSAR on-orbit organization maintenance tasks are in accordance with SSP 50005, paragraphs 12.3.1.2, Physical Accessibility Design Requirements, 12.3.1.3, Visual Access Design Requirements and meet program defined crew time allocations.</p>			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: I, D, & A	Hazard Report(s):
<p>I. On-orbit relocation of the Attached Payload: No reverification required.</p> <p>II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.</p>			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
<p>Applicable Document(s):</p> <p>SSP 30256</p> <p>SSP 50005, paragraphs 14.3.2.3.1, 14.4.3 and 4, 12.3.1.2, 12.3.1.3</p> <p>SSP 57003, par. 3.1.3.1.1.3, 3.8.2.1, 3.8.3.1, 3.8.3.1.1, 3.8.3.1.1.3, 3.8.3.3.1.4, 3.8.3.4.1, 3.9.1.3, 3.9.1.6.7.1, 3.9.1.6.7.2, 3.9.1.7.5, 3.9.2.2.6, Figures 3.8.3.1.1.1-1, 3.8.3.1.1.3-1, and 3.8.3.4.1-1,</p>			

Appendix B Verification Definition Sheets

Number ME-039	Title MECHANICAL – LIGHTING DESIGN	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.1.1B Manual Failure Detection, Isolation, and Recovery (A)			
Requirement Summary: General and specialized lighting shall be provided by the Attached Payload.			
Detailed Descriptions of Requirements: Verification shall be by analysis using data from Hazard Analysis Reports, RBDA, FMEA, schematics, LSAR and software detailed design drawings. The requirements are considered successful when the analysis shows that general and specialized lighting are in accordance with the requirements.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.9.1.1.1			

Appendix B Verification Definition Sheets

Number ME-040	Title MECHANICAL – AUDIO DEVICE DISPLAYS	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.1.1C Manual Failure Detection, Isolation, and Recovery (A)			
Requirement Summary: Attached Payload visual and audible caution and warning devices shall be in accordance with SSP 57003, par. 3.9.1.1.1C			
Detailed Descriptions of Requirements: Verification shall be by analysis using data from Hazard Analysis Reports, RBDA, FMEA, schematics, LSAR and software detailed design drawings. The requirements are considered successful when the analysis shows compliance with SSP 57003, paragraph 3.9.1.1.1C.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.9.1.1.1			

Appendix B Verification Definition Sheets

Number ME-041	Title MECHANICAL – DISPLAYS	Method A&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.1.1.1A Manual Failure Detection, Isolation, and Recovery (A) 4.3.9.1.7.7.2 (A, B) Displays (I)			
Requirement Summary: These requirements define the crew interface for displays			
Detailed Descriptions of Requirements: Verification shall be by analysis using data from Hazard Analysis Reports, RBDA, FMEA, schematics, LSAR and software detailed design drawings. The requirements are considered successful when the analysis shows that human/equipment interfaces such as visual display devices, cursor control devices, and manual input devices are in accordance with SSP 50005, paragraph 12.3.2.1. The Attached Payload display types and locations shall conforms to the requirements in SSP 50005, paragraph 9.2 and the EVA displays are located within the field of view permitted by the EMU as defined in SSP 57003, paragraph 3.8.3.1.1.2			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A&I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.8.3.1.1.2, 3.9.1.1.1, 3.9.1.7.7.2 SSP 50005, par. 9.2, 12.3.2.1			

Appendix B Verification Definition Sheets

Number ME-042	Title MECHANICAL – MECHANICAL ATTACHMENT POINTS	Method A, I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.2.1 (A,B) EVA Releasable Capture Bar (I, A) 4.3.9.1.6.4 Lockwiring and Staking (I) 4.3.9.1.6.5 (A,B) Restraining and Handling Devices for Temporary Stowage (A)			
Requirement Summary: The Attached Payload shall interface with the PAS/UCCAS, capture bar, and grapple fixture as specified.			
Detailed Descriptions of Requirements: The Attached Payload must provide an EVA releasable capture bar and the design, location and tolerances are in accordance with SSP 57004 and SSP 50005. Verification shall be considered successful when the inspection shows that the requirement has been satisfied. An inspection and analysis shall verify a compatible grapple fixture and the grapple fixture interfaces. The verification shall be considered successful when the inspection shows compliance with the requirement as specified. An inspection of the flight drawings shall be performed to verify that no lockwire or staking is used on equipment installations or operational interfaces. An analysis of engineering design drawings shall be performed to verify that restraining and handling devices are provided for the EVA crew for equipment items designated for removal and replacement and for external equipment items that use robotic devices to provide temporary storage. The verification shall be considered successful when the analysis shows that these devices have been incorporated into the system design for the planned temporary storage.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A,I	Hazard Report(s):
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.1.3.2.1, 3.9.1.6.4, 3.9.1.6.5 SSP 57004 SSP 50005			

Appendix B Verification Definition Sheets

Number ME-043	Title MECHANICAL – COLOR	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.3.1.8 Color (I)			
Requirement Summary: EVA handrails/handholds and safety tether points must be yellow			
Detailed Descriptions of Requirements: An inspection of payload hardware and flight drawings shall be performed to verify requirement. The verification shall be considered successful when the inspection shows all EVA handrails/handholds which have been certified as safety tether points are yellow.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.8.3.3.1.8			

Appendix B Verification Definition Sheets

Number ME-044	Title MECHANICAL – ROBOTIC TRANSLATION	Method A, I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.5 (B, C, D) Equipment Requiring Robotic Translation (A, I) 4.3.1.4.2 Interface with Special Purpose Dexterous Manipulator (A)			
Requirement Summary: The Attached Payload shall perform robotic translation without violating the EVR clearance envelope.			
Detailed Descriptions of Requirements: An inspection of the flight drawings shall be performed to verify that the distance between the Attached Payload SSRMS GF and its POA GF does not exceed 16.4-ft (5m). Inspection of the flight drawings shall be performed to verify that Attached Payloads requiring robotic translation support does not have requirements for electrical power, data, or video for the SSRMS LEE, MCAS or POA during translation. Verification of an Attached Payload that requires robotic translation support shall be by analysis. The verification shall be considered successful when the analysis shows the Attached Payload does not extend beyond the robotics translation corridor specified in SSP 41162, paragraph 3.2.2.7. Translation of the SPDM robotic arm with the Attached Payload equipment or ORUs shall be verified by analysis. The analysis shall be based on review of the ISS traffic model, system design and flight element drawings and the data from functional interface test and dynamic simulations conducted during end item certification activities. The analysis shall be considered successful when data shows that the SPDM robotic arm with the Attached Payload equipment or ORUs can translate without violating EVR clearance requirements.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 41162, par. 3.2.2.7 SSP 57003, par. 3.1.4.2, 3.7.5			

Appendix B Verification Definition Sheets

Number ME-045	Title MECHANICAL – EVR OPERATIONS	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s):			
4.3.7.3I External Equipment Requiring Space Station Remote Manipulator System Support			
4.3.7.6 Camera Requirements (TBD)			
4.3.9.1.7B Standard Extravehicular Activity/Extravehicular Robotics Interfaces (A)			
Requirement Summary: Attached Payloads that require robotic support must meet EVR equipment requirements			
Detailed Descriptions of Requirements:			
<p>An Attached Payload requiring SSRMS support shall be designed such that its needs for programmable backdrive after initial contact are within the SSRMS programmable force/moment accommodation capability of SSP 57003 Table 3.7.3–4, when the SSRMS elbow joint angle is not less than 60 degrees from straight–arm configuration and the maximum distance between the GF and the berthing contact point is 14.76 ft (4.5 m).</p> <p>The work-sites associated with the equipment that requires dexterous robotics support shall be verified by analysis. The analysis shall consist of analyzing verification data to show compliance with SSP 30550, Volume 1, paragraphs 4.3.3.1.1, 4.3.3.1.4, 4.3.3.1.5, 4.3.3.3.3, 4.3.3.3.5, 4.3.4.10.1.2, and 4.3.4.10.1.4. The verification shall be considered successful when the analysis shows the equipment meets the requirements.</p> <p>Standard EVR interfaces shall be used with equipment items designated for on-orbit, maintenance in non-pressurized areas. The verification shall be considered successful when the analysis proves that each device to be manipulated by EVR is in accordance with SSP 42004, and SSP 42003.</p>			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
<p>I. On-orbit relocation of the Attached Payload: No reverification required.</p> <p>II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.</p>			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 30550, Volume 1, paragraphs 4.3.3.1.1, 4.3.3.1.4, 4.3.3.1.5, 4.3.3.3.3, 4.3.3.3.5, 4.3.4.10.1.2, and 4.3.4.10.1.4. SSP 42003 SSP 42004 SSP 57003, par. 3.7.6, 3.9.1.7, and Table 3.7.3–4			

Appendix B Verification Definition Sheets

Number ME-046	Title MECHANICAL – INTERFACES	Method I, A, & T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.2.2 Mechanical Design Interface (I & T) 4.3.1.3.1.2.1 Payload Attach System Coordinate System Origin Location (I) 4.3.7.3 (A&K) External Equipment Requiring Space Station Remote Manipulator System Support (I) 4.3.7.3.1B Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (I) 4.3.7.4 C External Equipment Requiring Dexterous Robotic Support (A)			
Requirement Summary: Attached Payloads must accommodate the ISS and associated equipment mechanical interfaces.			
Detailed Descriptions of Requirements: <u>Mechanical Design Interface:</u> Verify by inspection of the Attached Payload drawings and test with flight like test article that the mechanical attach points are compatible with the MCAS as specified in SSP 42004. Verification shall be considered successful when the inspection and test confirm compatibility.			
<u>Payload Attach System Coordinate System Origin Location</u> Verification shall be by inspection. The inspection shall show that all analysis for the Attached Payload is in compliance with the convention established in SSP 57003, Figure 3.1.3.1.2.1-1. Verification shall be considered successful when the inspection shows that all analysis for the Attached Payload uses the proper convention.			
<u>External Equipment Requiring Space Station Remote Manipulator System (SSRMS) Support</u> A. An Attached Payload requiring Space Station Remote Manipulator System (SSRMS) support shall interface with the SSRMS Latching End Effector (LEE) using Power Data Grapple Fixture (PDGF) or a Shuttle GF that is compatible with the SSRMS LEE as specified in SPS 42004, Table 1.4.1.2–1. The GF to SSRMS LEE is an internal interface to the robotic subsystem. K. Verification shall be by inspection of flight drawings, in the unique hardware ICD, to determine that Attached Payloads requiring SSRMS support have defined the location of the GF.			
<u>Equipment Requiring SSRMS Support Using a NSTS Grapple Fixture:</u> Verification shall be by inspection of flight drawings to determine that Attached Payloads requiring SSRMS support have accommodated the Grapple Fixture in accordance with SSP 42004, section I3.2.2.2.			
<u>External Equipment Requiring Dexterous Robotic Support</u> The equipment requiring dexterous robot support shall be verified by analysis and inspection. The analysis shall consist of analyzing verification data to show compliance with SSP 30550, Volume 1, paragraphs 4.3.2.1.5, 4.3.2.2.4, 4.3.4.1.1 (excluding 4.3.4.1.1.5 and 4.3.4.1.1.6), 4.3.4.2.1.4, 4.3.4.2.1.5, 4.3.4.2.2 (excluding 4.3.4.2.2.1.3, 4.3.4.2.2.1.8, 4.3.4.2.2.1.10, 4.3.4.2.2.4, and 4.3.4.2.2.5), 4.3.4.3, 4.3.4.4.1.5, 4.3.4.4.1.6, 4.3.4.6, 4.3.4.7.2.1, 4.3.4.8.1.1.3, 4.3.4.9.2.1, 4.3.4.9.2.5, 4.3.4.9.2.6, 4.3.4.13, 4.3.4.15, 4.3.5.3.1, and 4.3.5.3.2. The verification shall be considered successful when the analysis shows the equipment meets the requirements. The analysis and inspection is to verify that the dexterous handling interface is in accordance with SSP 42004, section C3.2, or D3.2, or G3.2, or H3.2 or K3.2 as applicable.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6

Appendix B Verification Definition Sheets

Number ME-046	Title MECHANICAL – INTERFACES	Method I, A, & T	Hazard Report(s)
Description of Reverification Requirements:		Reverification Method: I, A, & T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above if ground rack is used to ship/handle subrack payload.			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): NSTS 21000-IDD-ISS, Figure 14.4.7.4-1 SSP 30550, Volume 1 par. 4.3.2.1.5, 4.3.2.2.4, 4.3.4.1.1, 4.3.4.2.1.4, 4.3.4.3.1.5, 4.3.4.2.2, 4.3.4.3, 4.3.4.4.1.5.4.3.4.4.1.6, 4.3.4.6, 4.3.4.7.2.1, 4.3.4.8.1.1.3, 4.3.4.9.2.1, 4.3.4.9.2.5, 4.3.4.9.2.6, 4.3.4.13, 4.3.4.15, 4.3.5.3.1, 4.3.5.3.2 SSP 42004, SECTION C3.2, D3.2, G3.2, H3.2, K3.2 SSP 57003, par. 3.1.2.2 , 3.1.3.1.2.1, 3.7.1, 3.7.3, 3.7.3.1 , 3.7.4			

Appendix B Verification Definition Sheets

Number ME-047	Title MECHANICAL – EVA CONTINGENCY OPERATIONS	Method A, D&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s):			
4.3.1.3.2.3C Passive Umbilical Mechanism Assembly (A)		4.3.8.2 Extravehicular Activity Translation (A)	
4.3.8.A Extravehicular Activity (A, D & I)		4.3.9.1.7A Standard Extravehicular	
4.3.8.1 (A, B, C) Extravehicular Activity as a Backup for Robotics activities (A)		Activity/Extravehicular Robotics Interfaces (A)	
		4.3.9.2.2.5 On-Orbit Maintenance Back-up (A)	
Requirement Summary: These requirements specify analysis that will verify contingency EVA capability			
Detailed Descriptions of Requirements: An analysis of Attached Payload flight drawings shall be used to verify that manual EVA backup provisions have been provided in accordance with SSP 50005, paragraph 12.3.			
EVA contingency operations shall be verified by analysis, demonstration, and inspection. Verification shall be considered successful when the analysis, demonstration, and inspection confirms all EVA contingency activity performed at the end of the SSRMS or from existing ISS work-sites, is in accordance with NSTS 07700, Volume XIV, Appendix 7.			
An analysis of Attached Payload flight drawings shall be used to verify that manual backup provisions have been provided in accordance with SSP 50005, paragraph 12.3.			
An analysis shall be used to show that EVA translation paths on Attached Payloads exist only for the purpose of removing the SSRMS from a grapple fixture.			
An analysis of engineering design drawings shall be performed to verify that standard EVA interfaces are used with equipment items designated for on-orbit, maintenance in non-pressurized areas in accordance with SSP 30256:001.			
Analysis shall be conducted using the physical constraints of the ORU, the end item installation physical constraints, and the applicable maintainability, and human factors criteria to prove that no more than two astronauts would be required to perform the ORU remove and replace actions which have been designed and planned for robotic execution.			
Required Verification Data: 1. Certificate of Compliance (COC)			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A,D&I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required.			
II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): NSTS 07700, Volume XIV, Appendix 7 SSP 30256 SSP 42131 SSP 50005, par 12.3 SSP 57003, par. 3.1.3.2.3, 3.8, 3.8.1, 3.8.2, 3.9.1.7, 3.9.2.2.5			

Appendix B Verification Definition Sheets

Number ME-048	Title MECHANICAL – SHARP EDGES, BURRS, AND PROTRUSIONS	Method A&I, A or I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8B Extravehicular Activity (A&I) 4.3.8.4.2.1.2 Thin Materials (A & I) 4.3.8.4.2.1.1 Sharp Edges (A & I) 4.3.8.4.2.2 Burrs (A & I) 4.3.8.4.2.1.1.1 (A, B, C, D) Exposed Edge Requirements (A & I) 4.3.9.2.1 Planned Maintenance and Storage (A or I) 4.3.8.4.2.1.1.2 (A, B) Exposed Corner Requirements (A & I)			
Requirement Summary: Burrs and catch points of the Attached Payload and PD-provided ancillary equipment must be removed/protected from equipment that is accessible to the crew.			
Detailed Descriptions of Requirements: <u>EVA</u> Verification shall be by analysis and inspection. Verification shall be considered successful when the analysis and inspection confirms that the design is in accordance with NSTS 07700, Volume XIV, appendix 7. <u>Sharp Edges/Exposed Edge and Corner Requirements</u> Verification shall be by analysis and inspection. An analysis shall be performed using data from drawings, integration documentation, and operational procedures to identify hardware edges and corners requiring rounding, the use of guards, or covers due to location in crewmember translation paths and maintenance worksites. A drawing inspection shall show that the required edge and corner rounding, deburring, or cover installation has been accomplished or proper guards are in place. Verification shall be considered successful when inspection of the hardware shows that all required edges or corners have been properly machined, covered, or guarded. The verification shall be successful when the analysis verifies that the exposed corners and edges do not pose a hazard to the EVA crew. <u>Burrs</u> Verification shall be by analysis and inspection. An analysis shall be performed using data from drawings, integration documentation, and operational procedures to identify all potential areas of burrs and the required use of procedures to identify and deburr surfaces due to location in the crewmember translation paths and maintenance worksites. A drawing inspection shall show that deburring is required. Verification shall be considered successful when analysis and inspection shows that all edges have been properly deburred. <u>Planned Maintenance and Storage</u> Verification shall be by analysis and inspection. A drawing inspection shall show that the required edge and corner rounding, deburring, or cover installation has been accomplished or proper guards are in place. Verification shall be considered successful when analysis and inspection shows that all required edges and corners have been properly machined, covered or guarded.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A&I	Hazard Report(s):

Appendix B Verification Definition Sheets

Number	Title	Method	Hazard Report(s)
ME-048	MECHANICAL – SHARP EDGES, BURRS, AND PROTRUSIONS	A&I, A or I	
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): NSTS 07700, Volume XIV, appendix 7 SSP 57003, par. 3.8, 3.8.4.2.1.1, 3.8.4.2.1.1.1, 3.8.4.2.1.1.2, 3.8.4.2.1.2, 3.8.4.2.2, 3.9.2.1			

Appendix B Verification Definition Sheets

Number ME-049	Title MECHANICAL – EVA CREW MEMBER FIELD OF VIEW	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.3.1.1.2 Extravehicular Activity Crew Member Field of View (A)			
Requirement Summary: Attached Payload equipment, controls displays and markings are located within the field of view of an EVA crewmember			
Detailed Descriptions of Requirements: An analysis shall be performed using documentation defining EVA tasks required at Attached Payload and flight element drawings to show that the equipment, controls, displays, and markings are positioned so that a crewmember in an EMU can see them while performing the task. The analysis shall be considered successful when the data shows that the equipment, controls, displays, and markings required to perform EVA tasks are located within the field of view defined in SSP 57003, Figure 3.8.3.1.1.2-1.			
Required Verification Data: 1. Certificate of Compliance (COC)		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.8.3.1.1.2, FIGURE 3.8.3.1.1.2-1			

Appendix B Verification Definition Sheets

Number ME-050	Title MECHANICAL – NON-IONIZING RADIATION	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.4.5 Transmitters (A)			
Requirement Summary: Crew requires protection from non-ionizing radiation			
Detailed Descriptions of Requirements: An analysis shall be performed using data from drawings, operational procedures, integration documentation, and timelines to show that Attached Payload with high power electromagnetic wave transmitters shall protect crewmembers from harmful exposure to non-ionizing radiation. In the event of EVA proximity operations near an Attached Payload with high power electromagnetic wave transmitters, Attached Payloads shall implement safing procedures to temporarily inhibit high power electromagnetic wave transmitters from operating during the duration of the EVA proximity operations.			
Required Verification Data: 1. Certification of Compliance (COC)			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required.			
II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.			Data Submittal Dates: I. N/A II. Same as the original submittal dates.
Applicable Document(s): SSP 57003, par. 3.8.4.5			

Appendix B Verification Definition Sheets

Number ME-051	Title MECHANICAL-ROBOTIC HAND-OFF	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.2 External Equipment Requiring Robotic Hand-Off (I)			
Requirement Summary: Attached Payloads requiring robotic support must meet robotic hand-off requirements			
Detailed Descriptions of Requirements: An inspection of flight drawings shall be performed to verify hand-off support. The verification shall be considered successful when the inspection and analysis shows compliance with the requirement as specified.			
Required Verification Data: 1. Certificate of Compliance			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.7.2			

Appendix B Verification Definition Sheets

Number ME-052	Title MECHANICAL-GROUND MAINTENANCE	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.9.2.3 Ground Maintenance (A)			
Requirement Summary: Attached Payloads must meet maintenance selection criteria LSAR Depot maintenance.			
Detailed Descriptions of Requirements: Analysis shall be conducted using ORU selection criteria, Repair Level Analysis (RLA), and other logistic analyses of repair feasibility. The verification shall be considered successful when the analysis proves that depot resources are available or feasible for LSAR Depot maintenance tasks selected in accordance with program approved Logistics Support Analysis (LSA) physical and economic criteria.			
Required Verification Data: 1. Certificate of Compliance (COC)		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.9.2.3			

Appendix B Verification Definition Sheets

Number ME-053	Title MECHANICAL-PROTECTION FROM MOVING EQUIPMENT	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.1K Equipment Requiring Shuttle Robotic Support (A) 4.3.8.4.3 Moving or Rotating Equipment (A)			
Requirement Summary: Attached Payloads must provide protection for the crew from rotating equipment			
Detailed Descriptions of Requirements: An analysis shall be performed using data from drawings, operational procedures, integration documentation, and time lines to identify equipment that is designed to rotate or move, operations that require EVA crewmembers to be in the area of the equipment, scenarios involving direct interface between EVA crewmembers and the equipment, and controls to prevent unwanted equipment movement. Analysis shall be performed to verify that EVA crew is not required to operate or translate near hazardous moving equipment. Verification shall be considered successful when the analysis verifies that it is not necessary for the EVA crewmembers to operate near moving or rotating equipment. Verification that Attached Payloads requiring SRMS support shield critical and hazardous components from contact with other objects during robotic operations shall be performed by analysis.			
Required Verification Data: 1. Certificate of Compliance (COC)		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par.3.7.1, 3.8.4.3			

Appendix B Verification Definition Sheets

Number ME-054	Title MECHANICAL-SPDM FIXTURE LOCATIONS AND STRUCTURAL SUPPORT	Method A&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.4.2.1 (A-B) Special Purpose Dexterous Manipulator Fixture Locations (I) 4.3.1.4.2.2 Special Purpose Dexterous Manipulator Fixture Structural Support (A)			
Requirement Summary: Attached Payloads with SPDM interfaces for on-orbit activities must meet the specified requirements.			
Detailed Descriptions of Requirements: <u>SPDM Locations</u> The accommodation of SPDM fixtures (i.e., microconicals) on the Attached Payload shall be verified by inspection. The inspection shall be based upon documentation defining the required SPDM fixture(s), the Attached Payload flight drawings, and SSP 57004. An inspection of the Attached Payload flight drawings shall be performed to ensure that all SPDM fixture interfaces are in accordance with SSP 42004 and the location constraints of SSP 57004. The inspection shall be considered successful when the Attached Payload flight drawings document that all SPDM fixtures are in accordance with SSP 42004 and SSP 57004. <u>SPDM Support</u> An analysis shall be performed of the Attached Payload structure production drawings to verify that the SPDM fixture accommodations are in accordance with SSP 57003, section 3.7 and SSP 30559 are provided.			
Required Verification Data: 1. Certificate of Compliance (COC)		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 30559 SSP 57003, par. 3.1.4.2.1, and 3.1.4.2.2, section 3.7 SSP 57004			

Appendix B Verification Definition Sheets

Number EL-001	Title ELECTRICAL – STEADY-STATE VOLTAGE CHARACTERISTICS	Method A, T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.1.1 Steady-State Voltage Characteristics (T) 4.3.7.3.2D Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)			
Requirement Summary: Attached Payload must be compatible with the nominal ISS voltage range.			
Detailed Descriptions of Requirements: Verification of compatibility with Steady-state voltage limits shall be performed by test at low and high input voltage values of 113 to 126 Vdc. The Attached Payload shall be operated under selected loading conditions that envelope operational loading. The verification shall be considered successful when the test shows under low and high voltage conditions the Attached Payload is compatible with the steady-state voltage limits of 113 to 126 Vdc and equipment requiring SSRMS support using PDGF meets the requirement of SSP 42004, paragraph A3.2.2.5.1.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 42004, par. A3.2.2.5.1 SSP 57003, par. 3.2.2.1.1, 3.7.3.2			

Appendix B Verification Definition Sheets

Number EL-002	Title ELECTRICAL – RIPPLE VOLTAGE CHARACTERISTICS, NOISE, AND SPECTRUM	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.1.2.1 Ripple Voltage and Noise (A) 4.3.2.2.1.2.2 Ripple Voltage Spectrum (A) 4.3.7.3.2D Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)			
Requirement Summary: These requirements ensure that all Attached Payloads or other electrical-power-consuming equipment are compatible with specific ripple voltage, ripple-voltage spectrum, and ripple-voltage noise characteristics of ISS.			
Detailed Descriptions of Requirements: Ripple Voltage and Noise requirements shall be verified by analysis. The verification shall be considered successful when: 1). The analysis shows the Attached Payload is compatible with the EPS time domain ripple voltage and noise level of 2.5 Vrms maximum during high and low voltage conditions from 30 Hz to 10 kHz, 2). Analysis of the CS-01 and CS-02 test data, generated as a result of SSP 57003, paragraph 4.3.2.2.4, shows the Attached Payload at interface C is compatible with the ripple voltage spectrum in SSP 57003, Figure 3.2.1.2.2-1 and 3). Equipment requiring SSRMS support using the PDGF meets the requirement of SSP 42004, paragraph A3.2.2.5.1.			
Required Verification Data: 1. Data Cert providing plot of input voltage vs. frequency.			Data Submittal Dates: 1. L-12
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.			Data Submittal Dates: I. N/A II. L-12
Applicable Document(s): SSP 42004, par. A3.2.2.5.1 SSP 57003, par. 3.2.2.1.2.1, 3.2.2.1.2.2, 3.2.2.4, 3.7.3.2, Fig. 3.2.1.2.2-1			

Appendix B Verification Definition Sheets

Number EL-003	Title ELECTRICAL – TRANSIENT VOLTAGES	Method A or T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.1.3.1 Normal Transient Voltages (A or T) 4.3.7.3.2D Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)			
Requirement Summary: Attached Payloads must be compatible with voltage transients of the ISS electrical power system.			
Detailed Descriptions of Requirement: Test or analysis shall verify transient voltage compatibility. Input voltage shall be 113 Vdc and 126 Vdc with the Interface C source impedance, as specified in SSP 30482, Volume I. Verification of compatibility with the specified Transient Voltages shall be performed by test or analysis of the Attached Payload operation across the transient envelope as specified in SSP 57003, Figure 3.2.1.3.1-1. The verification shall be considered successful when the test or analysis shows the Attached Payload is compatible with the EPS transient voltage characteristics as specified in SSP 57003, Figure 3.2.1.3.1-1 and equipment requiring SSRMS support using the PDGF meets the requirement of SSP 42004, paragraph A3.2.2.5.1.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A or T	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 30482, Vol. I SSP 57003, par. 3.2.2.1.3.1, 3.7.3.2, Fig. 3.2.1.3.1-1 SSP 42004, par. A3.2.2.5.1.			

Appendix B Verification Definition Sheets

Number EL-004	Title ELECTRICAL – FAULT CLEARING AND PROTECTION	Method A,I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.1.3.2 Fault Clearing and Protection (A) 4.3.7.3.2 (C, D) Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A,I)			
Requirement Summary: The Attached Payload must be compatible with short-duration high voltage transients that can result from ISS fault clearing and protection system operation.			
Detailed Descriptions of Requirements: Fault Clearing and Protection shall be verified by analysis. The verification shall be considered successful when analysis shows the Attached Payload at Interface C does not produce an unsafe condition or one that could result in damage to ISS equipment or Attached Payload hardware from the EPS transient voltages as specified in SSP 57003, Figure 3.2.2.1.3.2-1 and equipment requiring SSRMS support using the PDGF meets the requirement of SSP 42004, paragraph A3.2.2.5.1.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A,I	Hazard Report(s):
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 42004, par. A3.2.2.5.1 SSP 57003, par. 3.2.2.1.3.2, 3.7.3.2, Fig. 3.2.2.1.3.2-1			

Appendix B Verification Definition Sheets

Number EL-005	Title ELECTRICAL – NON-NORMAL VOLTAGE RANGE	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.1.3.3 (A, B) Interface C Non-Normal Voltage Range (A) 4.3.7.3.2D Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)			
Requirement Summary: The Attached Payload must not produce an unsafe condition or one that could result in damage to ISS equipment when non-normal voltages occur.			
Detailed Descriptions of Requirements: Verification of compatibility with Non-Normal voltage range conditions shall be performed by analysis. The analysis shall ensure that the Attached Payload will not produce an unsafe condition nor a condition that could result in damage to ISS equipment external to the Attached Payload, when non-normal voltage levels as specified are present. The analysis should be performed with all converters directly downstream of Interface C. Verification of compatibility with undervoltage conditions shall be performed by analysis. The analysis shall ensure the Attached Payload will not produce an unsafe condition or one that could result in damage to ISS equipment external to the Attached Payload when parameters are as specified in SSP 57003, paragraph 3.2.2.1.3.3. The analysis should be performed with all converters directly downstream of Interface C. The verification shall be considered successful when analysis shows that the Attached Payload is safe within ISS interface conditions as specified and equipment requiring SSRMS support using the PDGF meets the requirement of SSP 42004, paragraph A3.2.2.5.1.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 42004, par. A3.2.2.5.1 SSP 57003, par. 3.2.2.1.3.3, 3.7.3.2			

Appendix B Verification Definition Sheets

Number EL-006	Title ELECTRICAL – HRDL CONNECTORS/ PIN ASSIGNMENTS	Method I&D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.4.7 High Rate Data Link Connector/Pin Assignments (I) 4.3.2.2.2.1 (A,B) Attached Payload Connectors and Pin Assignments (I&D)			
Requirement Summary: High Rate Data Link (HRDL) Connector/Pin assignments are required			
Detailed Descriptions of Requirements: Verification shall be by inspection of the Attached Payload UMA HRDL connector/pin assignments to the unique Attached Payload hardware ICD, SSP 57004 and by analysis of the passive-half UMA. Verification shall be considered successful when the inspection shows that the connector and pin assignments in accordance with paragraph 3.2.1 of SSP 57004 and when the analysis shows that the Attached Payload UMA configuration has provided the capability of achieving berthing with the contact conditions and misalignments consistent with truss interface as defined in the Unique Attached Payload ICD. Attached Payload to ISS connectors shall be verified by inspection and demonstration. The verification shall be considered successful when an inspection of the Attached Payload specifications and drawings shows the Attached Payload connector plug is the Passive UMA connector NUR1-005 or NASA approved equivalent meets the requirements for this connector as defined in SSQ 21637. Pin Assignments shall be verified by inspection and demonstration. The verification shall be considered successful when an inspection of the Attached Payload specifications and drawings shows the Attached Payload connector plug is the Passive UMA connector NUR1-005 or NASA approved equivalent meet the pin assignments and avionics interface terminations as specified in the Unique Payload Hardware Interface Control Document per SSP 57004 and demonstrates successful mating with the active UMA connector on the common attach system interface verification test article.			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: I&D	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.2.2.2.1 & 3.3.2.4.7 SSP 57004, par. 3.2.1 SSQ 21637			

Appendix B Verification Definition Sheets

Number EL-007	Title ELECTRICAL – POWER BUS ISOLATION	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.2A Power Bus Isolation (A) 4.3.2.2.2B Power Bus Isolation (A)			
Requirement Summary: Power buses must be isolated from structure and from each other.			
Detailed Descriptions of Requirements: Verification of Power Bus Isolation between two independent ISS Power feeds as specified, shall be performed by analysis. The verification shall be considered successful when the analysis shows the Attached Payload, with a source voltage of + 126 Vdc, and its internal and external Attached Payload Electrical Power Consuming Equipment (EPCE) provides a minimum of 1-megohm isolation in parallel with not more than 0.03 microfarads of mutual capacitance between the two independent power feeds including both the supply and return lines. Verification of Power Bus Isolation without the use of diodes shall be verified by analysis. The analysis shall show the exclusion of diodes used to isolate the two independent ISS power bus high side or return lines. The verification shall be considered successful when analysis shows there are no diodes used, to electrically tie together independent ISS power bus high side or return lines, within the Attached Payload and its internal and external EPCE.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.2.2.2.2 (A, B)			

Appendix B Verification Definition Sheets

Number EL-008	Title ELECTRICAL – COMPATIBILITY WITH SOFT START/STOP RPC	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.2.3 Compatibility With Soft Start/Stop RPC (T)			
Requirement Summary: This requirement ensures that the Attached Payload can initialize operation and is compatible with the soft start/stop characteristics of the ISS remote power controllers.			
Detailed Descriptions of Requirements: Compatibility with Soft Start/Stop RPC(s) shall be verified by test. Verification of initialization with soft start/stop performance characteristics shall be performed by test when the initial supply of power is provided to the equipment connected to the RPC(s). Input power to the Attached Payload shall be delivered through a PRCU or equivalent. The Attached Payload connected to interface C shall be operated with multiple load combinations at levels ranging from 0% to 100% of the RPC rated conductivity. Verification may be performed by the PRCU or NASA approved equivalent.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.2.2.2.3			

Appendix B Verification Definition Sheets

Number EL-009	Title ELECTRICAL – SURGE CURRENT	Method A&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.2.4 (A, B) Surge Current (A&T)			
Requirement Summary: The EPCE surge currents upon activation and deactivation must not exceed the allowable limits.			
Detailed Descriptions of Requirements: Surge Current amplitude and Surge Current rate of current change shall be verified by test and analysis. Input power to the Attached Payload should be representative of the ISS power environment. Verification of compatibility with Surge Current limits shall be performed by test at high, nominal, and low input voltage values as specified. The power source used to perform the test shall be capable of providing a range of power between 0 kW to 3 kW at 113-126 Vdc. The Attached Payload EPCE shall be operated under selected loading conditions that envelope operational loading. The analysis shall be performed using test data from the above test. The analysis shall indicate operability and compatibility exist based on test data and the requirements specified in SSP 57003, paragraph 3.2.2.2.4. The verification shall be considered successful when test and analysis shows under high, nominal and low voltage conditions the Attached Payload can perform all functional capabilities and prove compatibility by operating within the specified limits in SSP 57003, paragraph 3.2.2.2.4.			
Required Verification Data: 1. Analysis report including surge current profiles for Attached Payload configurations. 2. Test Report.			Data Submittal Dates: 1. L-12 2. L-12
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A&T	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.			Data Submittal Dates: I. N/A II. Same as the original submittal dates.
Applicable Document(s): SSP 57003, par. 3.2.2.2.4			

Appendix B Verification Definition Sheets

Number EL-010	Title ELECTRICAL – REVERSE ENERGY/CURRENT	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.2.5 Reverse Energy/Current (A)			
Requirement Summary: The equipment must not introduce unacceptable Reverse Energy/Current into the ISS power system.			
Detailed Descriptions of Requirements: Reverse Energy/Current shall be verified by analysis. Input power to the Attached Payload should be representative of the ISS power environment. Verification of compatibility with Reverse Energy/Current limits shall be performed by analysis at 3 kW values corresponding to the Attached Payload design. The power source used to perform the analysis shall be capable of providing a range of power between 0 kW to 3 kW at 113-126 Vdc. The Attached Payload shall be analyzed under selected loading conditions that envelope operational loading. The verification will be considered successful when analysis shows that the Attached Payload complies with requirements defined in SSP 57003, Table 3.2.2.2.5-1 for the reverse energy/current into the upstream power source. Also, when the reverse energy or the reverse current requirement for all environmental conditions specified in this document when powered from a voltage source with characteristics specified in SSP 57003, paragraphs 3.2.2.1 and 3.2.2.2 with a source impedance of 0.1 ohm is met.			
Required Verification Data: 1. Data Cert. comparing worst case reverse current and potential reverse current case conditions to SSP 57003, Table 3.2.2.2.5-1 allowables. 2. Updated Data Cert. comparing worst case reverse current and potential reverse current case conditions to SSP 57003, Table 3.2.2.2.5-1 allowables (if required).			Data Submittal Dates: 1. L-20 2. L-12
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.			Data Submittal Dates: I. N/A II. L-20
Applicable Document(s): SSP 57003, par. 3.2.2.1, 3.2.2.2, 3.2.2.2.5 and Table 3.2.2.2.5-1			

Appendix B Verification Definition Sheets

Number EL-011	Title ELECTRICAL – HRDL CONNECTORS	Method I&D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.4.6 High Rate Data Link Connectors (I&D)			
Requirement Summary: The Attached Payload must interface to the HRDL through the passive half of the UMA			
Detailed Descriptions of Requirements: Verification shall be by inspection of the Attached Payload to UMA HRDL connector and demonstration of the Attached Payload UMA HRDL connector to mate with a test connector SSQ 21635, NATC07T13N4SN. Verification shall be considered successful when the inspection and demonstration show compliance with 3.3.2.4.6			
Required Verification Data: 1. Certificate of Compliance		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: I&D	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.3.2.4.6 SSQ 21635			

Appendix B Verification Definition Sheets

Number EL-012	Title ELECTRICAL – LARGE SIGNAL STABILITY	Method T & A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.2.8 Large Signal Stability (T&A)			
Requirement Summary: A large signal stability test is required for the Attached Payload.			
Detailed Descriptions of Requirements: Large signal stability shall be verified by test and analysis. A large signal stability test shall be conducted for the Attached Payload connected to Interface C. An integrated analysis shall be provided for representative maximum and minimum power loading to demonstrate that impedance variations will not impact system stability. The input and transient response waveform for the Attached Payload shall be recorded from the start of the pulse through the time when the transient diminishes to and remains below 10 percent of the maximum amplitude of the response. The test and analysis shall be considered successful when results show transient responses, measured at the input to the Attached Payload, diminish to 10 percent of the maximum amplitude within 1.0 milliseconds and remain below 10 percent thereafter.			
Required Verification Data: 1. Test Report showing compliance with the Unique Payload Hardware ICD Analysis Data			Data Submittal Dates: 1. L-12
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required.			
II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.			Data Submittal Dates: I. N/A II. L-12
Applicable Document(s): SSP 57003, par. 3.2.2.2.8			

Appendix B Verification Definition Sheets

Number EL-013	Title ELECTRICAL – WIRE DERATING	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.3.1 Wire Derating (A)			
Requirement Summary: Wires must be derated for location and temperature of operation, and downstream wires from a protective device must have the capability of carrying the full current load.			
Detailed Descriptions of Requirements: Wire Derating shall be verified by analysis. Analysis shall be based upon electrical schematics in accordance with derating criteria for loads at and downstream of the Attached Payload Port Interface (APPI) per NASA TM 102179, Selection of Wires and Circuit Protective Devices for STS Orbiter Vehicle Payload Electrical Circuits, as interpreted by NSTS 18798, TA-92-038. The verification shall be considered successful when the analysis shows the Attached Payload to ISS power interface or Attached Payload EPCE meets Wire Derating requirement as specified in SSP 57003, paragraph 3.2.2.3.1.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): NSTS/ISS 18798, Tech-memo 102179 SSP 57003, par. 3.2.2.3.1			

Appendix B Verification Definition Sheets

Number EL-014	Title ELECTRICAL – EXCLUSIVE POWER FEEDS	Method D&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.3.2 Exclusive Power Feeds (D&I)			
<p>Requirement Summary:</p> <p>If multiple power sources are connected to one piece of equipment, power on/off indicators must correctly indicate the existence of an active power source if one power source is turned off but the other is not.</p>			
<p>Detailed Descriptions of Requirements:</p> <p>The Attached Payload design with exclusive power feeds shall be verified by demonstration and inspection. The demonstration shall be considered successful when the result shows each individual Attached Payload will be provided power from its dedicated Attached Payload to ISS power interface location and no intra-site cabling exists. The inspection shall be considered successful when the result shows each individual S3/P3 attach site input power cabling will interface to a dedicated Attached Payload to ISS power interface and no cabling from external source(s) exists.</p>			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
<p>I. On-orbit relocation of the Attached Payload: No reverification required.</p> <p>II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.</p>			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.2.2.3.2			

Appendix B Verification Definition Sheets

Number EL-015	Title ELECTRICAL – ELECTROMAGNETIC INTERFERENCE/COMPATIBILITY	Method T&A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.4 Electromagnetic Compatibility (T&A) 4.3.2.2.4.9 Electromagnetic Interference Susceptibility for 4.3.2.2.4.4 Electromagnetic Interference (T&A) Safety Critical Circuits (T&A) 4.3.2.2.4.6 Alternating Current Magnetic Fields (T) 4.3.7.3.2I Equipment Requiring Space Station Remote 4.3.2.2.4.7 Direct Current Magnetic Fields (T or A) Manipulator System Support using a Power Data Grapple Fixture(A)			
Requirement Summary: All Attached Payloads must assure electromagnetic compatibility and protect against electromagnetic interference.			
Detailed Descriptions of Requirements: <u>A. Electromagnetic Compatibility</u> The requirements of SSP 30243, Space Station Requirements for Electromagnetic Compatibility, paragraphs 3.1 and 3.6.2 shall be verified by test and analysis. The test shall be considered successful when results show the Attached Payload connected to Interface C meet the requirements specified in SSP 30243 paragraph 3.6.2. The results of the EMC test shall be documented in the EMC test plan/report. The analysis shall be documented in an EMC Control Plan and Design Analysis Report. The analysis shall include determining the necessary requirements for equipment not connected directly to Interface C such that the entire payload meets the EMC requirements of SSP 57003. The analysis shall be considered successful when results show that requirements defined in SSP 30243, paragraph 3.1 have been met. NOTE: <ul style="list-style-type: none"> The Control Plan and the Design Analysis Report can be combined into one document per payload provider format. Clarifications to SSP 30243, paragraph 3.6.2: <ul style="list-style-type: none"> Only the impedance characteristics of the power source need to simulated Only representative simulated signals and loads for the interface tests are required Verification of the on-orbit configuration of the integrated rack may be performed analytically if and only if the on-orbit configuration differs from the Qualification Test configuration Details of the EMC Control Plan, Design Analysis Report, and EMC Test Plan/Report are located in Appendix G. If analysis shows requirements of paragraph 3.6.2 of SSP 30243 are met during Attached Payload EMI testing, as defined in paragraph 3.2.2.4 of this document, a separate EMC test plan/report is not needed. <u>B. Electromagnetic Interference</u> The Electromagnetic Interference of the Attached Payload EPCE shall be verified by test and analysis. Tests shall be performed and data submitted for conducted susceptibility and radiated susceptibility, in addition to that for conducted emissions and radiated emissions. This data shall be evaluated against the limits of SSP 30237. The test shall be considered successful when the results show requirements of SSP 30237 are met by the Attached Payload. The test results shall be documented in the EMI test plan/report. The analysis of each Attached Payload to ISS power interface shall be performed using equipment test data as mentioned in the above paragraph. The analysis shall be considered successful when the results show requirements of SSP 30237 are met by the Attached Payload. This analysis includes evaluating the degree of isolation from 30 Hz to 400 MHz provided by the Attached Payload EPCE for power ripple and transients to the equipment using isolated power. An analysis of the isolation in conjunction with the equipment conducted requirements should be submitted in the EMC Control Plan to verify the requirements in SSP 57003 are met.			

Appendix B Verification Definition Sheets

Number EL-015	Title ELECTRICAL – ELECTROMAGNETIC INTERFERENCE/COMPATIBILITY	Method T&A	Hazard Report(s)
<p><u>C. Alternating Current (ac) Magnetic Fields</u></p> <p>The AC Magnetic Fields requirement for the Attached Payload connected to Interface C, including cables and interconnecting wiring, shall be verified by test. The test shall be performed using the MIL-STD-462D, Measurement of EMI Characteristics, RE01 Method with the following modifications: A. Test setup guidelines will be per SSP 30238, Figure 3-9 or 3-10, not the setup identified by MIL-STD-462D. B. Guidelines of SSP 30238, Figure 3-9 and 3-10, requirement of 1 meter separation does not apply to RE01. C. Measurements are required from 30 Hz to 50 kHz rather than 100kHz required by MIL-STD-461D. D. Measurements are performed at 7cm from the generating equipment. In the event emissions are out-of-specification, measurements are performed at 50 cm from the generating equipment. Emissions greater than 20 dB below the specified limits shall be recorded in the EMI test report. In cases where the noise floor and ambient are not 20 dB below specified level, only those emissions above the noise floor/ambient are required to be recorded. The verification shall be considered successful when test results show the generated ac magnetic fields of the Attached Payload connected to Interface C, including cables and interconnecting wiring, do not exceed 140 dB above 1 picotesla between 30 Hz to 240 dB per decade to 50 kHz.</p> <p><u>D. Direct Current (dc) Magnetic Fields</u></p> <p>The DC magnetic fields requirement for Attached Payloads with electromagnetic and/or permanent magnetic devices shall be verified by test or analysis. The measurement or analysis of DC magnetic fields shall be performed if there is a DC magnetic field greater than 170 dB above 1 picotesla. Additional measurements or analysis shall be performed at 10 cm increments away from the generating equipment until data proves the DC magnetic fields are 6 dB below the 170 dB above 1 picotesla requirement. The verification shall be considered successful when test or analysis results show the generated dc magnetic fields of the Attached Payload do not exceed 170 dB above 1 picotesla at a distance of 7 cm from the external surfaces of the Attached Payload. The includes electromagnetic and permanent magnetic devices.</p> <p><u>E. Equipment Requiring Space Station Remote Manipulator System Support using a Power Data Grapple Fixture.</u></p> <p>An analysis shall be performed to verify that Attached Payloads requiring SSRMS support complies with the electromagnetic effects requirements as defined in SSP 42004, section A3.2.2.9.1.</p>			
<p>Required Verification Data:</p> <ol style="list-style-type: none"> 1. The EMI/EMC Control, Test Plan and Design Analysis Report (first submission with plans, design data, and developmental data), as given in Appendix F. 2. Test Report for Item A (Results must be provided for each configuration in the worst-case operational modes. The report should include the test configuration/layout (including cables), photographs of the test configuration, and a description of testing equipment.) 3. Test results in electronic format as specified in Appendix G, for Item A and B. 4. For requirement 4.3.2.2.4.7 item D above, a tabular listing of each magnetic field measurement, distance from EUT, and mode of EUT operation. 5. For item C above, emissions greater than 20 dB below specified limits will be recorded in the EMI test report. In cases where the noise floor and ambient are not 20 dB below specified level, only those emissions above the noise floor/ambient are required to be recorded. 6. Certificate of Compliance (COC) for Item D & E above. 			<p>Data Submittal Dates:</p> <ol style="list-style-type: none"> 1. L-22 2. L-12 3. L-12 4. L-12 5. L-12 6. L-6
Description of Reverification Requirements:		Reverification Method: A&T	Hazard Report(s):
<p>I. On-orbit relocation of the Attached Payload: No reverification required.</p> <p>II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.</p>			

Appendix B Verification Definition Sheets

Number EL-015	Title ELECTRICAL – ELECTROMAGNETIC INTERFERENCE/COMPATIBILITY	Method T&A	Hazard Report(s)
Required Reverification Data: I. N/A II. a. Analysis report (results must be provided for each configuration in the worst-case operational modes). The report should include the test configuration/layout (including cables), and a description of EMI impacts (installed or removed) explaining how the results of the integrated analysis is derived. b. Test results in electronic format in accordance with Appendix G.			Data Submittal Dates: I. N/A II. a. L-12 b. L-12
Applicable Document(s): MIL-STD-462 SSP 30237 (Entire Document) SSP 30238 (Entire Document) SSP 30243, par. 3.1, 3.5 and 3.6.2 SSP 42004, Section A3.2.2.9.1 SSP 57003, par. 3.1.1.4.G, 3.2.2.4, 3.2.2.4.4, 3.2.2.4.6, 3.2.2.4.7, 3.2.2.4.9, 3.7.3.2			

Appendix B Verification Definition Sheets

Number EL-016	Title ELECTRICAL – CABLE/WIRE DESIGN AND GROUNDING	Method T&A&I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.4.1 Electrical Grounding (T&A) 4.3.2.2.4.3 Cable/Wire Design and Control Requirements (T, A, or I)			
Requirement Summary: Equipment must be electrically grounded and cable/wire design requirements must be met.			
Detailed Descriptions of Requirements: <u>Electrical Grounding</u> The electrical grounding of the Attached Payload EPCE shall be verified by test and analysis. The test shall be considered successful when the results show that the Attached Payload EPCE is in compliance with the requirements in Section 3 of SSP 30240. The analysis will be based on end item qualification data and Attached Payload design and analysis data. The analysis will be considered successful when the data shows the Attached Payload EPCE is electrically grounded within the requirements of Section 3 of SSP 30240. <u>Cable/Wire Design and Control Requirements (External Cables)</u> The cable and wire design of the Attached Payload EPCE external cables shall be verified by test, analysis, or inspection. The test shall be considered successful when the results show all requirements of SSP 30242, Space Station cable/wire design and control requirements for electromagnetic compatibility, are met. The analysis shall be based on attached payload design and analysis data. The analysis shall be considered successful when the results show all requirements of SSP 30242 are met. The inspection shall be based on physical/visual indications of the attached payload EPCE. The inspection shall be considered successful when physical/visual indications show that external cable and wire design is in compliance with the requirements can normally be met by inspection of drawings and hardware. Analysis is required to determine impedance and sensitivity characteristics of the circuit when classification cannot be determined by examination of the circuit known characteristics.			
Required Verification Data: 1. Analysis report showing (A.) compliance of actual grounding (based on end item qualification test data) versus grounding design philosophy (in Design Analysis Report), and (B.) the compliance with SSP 30242.			Data Submittal Dates: 1. L-12
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: A&I	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.			Data Submittal Dates: I. N/A II. L-12
Applicable Document(s): SSP 30240, Sec. 3 SSP 30242 SSP 57003, par. 3.2.2.4.1, 3.2.2.4.3, 3.7.3I, Table 3.7.3-4			

Appendix B Verification Definition Sheets

Number EL-017	Title ELECTRICAL – BONDING	Method A&I, T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.4.2 Electrical Bonding (T, A&I)			
Requirement Summary: Equipment must be electrically bonded.			
Detailed Descriptions of Requirements: The electrical bonding of the Attached Payload EPCE shall be verified by test, analysis and inspection. The test will be considered successful when the results show all requirements of SSP 30245 and the requirements in Sections 213 and 220 of NSTS 1700.7 ISS Addendum are met. The analysis will be based on end item qualification data and Attached Payload EPCE design and analysis data. The analysis will be considered successful when the data shows the Attached Payload EPCE is electrically bonded within the requirements of SSP 30245 and Sections 213 and 220 of NSTS 1700.7 ISS Addendum are met. The inspection will be based on physical/visual indications of the Attached Payload. The inspection will be considered successful when physical/visual indications show all requirements of SSP 30245 and Sections 213 and 220 of NSTS 1700.7B/ISS Addendum are met.			
Required Verification Data: 1. Test report showing compliance with SSP 30245 and NSTS 1700.7B/ISS, 213 and 220. 2. Analysis report showing compliance with SSP 30245, NSTS 1700.7B/ISS, 213 and 220, and the Unique Payload Hardware ICD.			Data Submittal Dates: 1. L-12 2. L-12
Description of Reverification Requirements:		Reverification Method: A&T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required.			
II. On-orbit change out (new, re-flight, or series) of the Attached Payload connected at interface C: A revised analysis shall be performed for each configuration change where the bonding scheme is modified or when electrical drawings are modified. Measurements will be made of the bonding for new and refurbished assemblies prior to flight.			
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: I. N/A II. L-12
Applicable Document(s): NSTS 1700.7 ISS Addendum, Sec. 213 and 220 SSP 30245, (Entire Document) SSP 57003, par. 3.2.2.4.2			

Appendix B Verification Definition Sheets

Number EL-018	Title ELECTRICAL – ELECTROSTATIC DISCHARGE AND CORONA	Method I, T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.4.5B Electrostatic Discharge (I) 4.3.2.2.4.8 Corona (T)			
Requirement Summary: Unpowered equipment must not be susceptible to electrostatic discharges of less than 15, 000 volts. The equipment must not produce damaging or destructive corona.			
Detailed Descriptions of Requirements: <u>Electrostatic Discharge (ESD)</u> The labeling of unpowered Attached Payload EPCE shall be verified by inspection. The inspection shall be considered successful when physical/visual indications show the labeling of Attached Payload EPCE susceptible to ESD up to 15000 V is in accordance with MIL-STD-1686A. <u>Corona (Preventing Corona)</u> The preclusion of damaging or destructive corona for Attached Payload EPCE in its operating environment shall be verified by test for equipment with all operating voltages less than 200 volts. Equipment with operating voltages greater than 200 Volts or equipment containing gaseous mixtures shall require additional analysis or test to the degree necessary to ensure no damaging effects due to destructive corona will exist in its operating environment. Equipment with operating voltages greater than 200 Volts or equipment containing gaseous mixtures shall require additional analysis or test to the degree necessary to ensure no damaging effects due to destructive corona will exist in its operating environment. The test shall be considered successful when the results show the absence of corona that is damaging or destructive to Attached Payload EPCE during functional testing, provided all operations can be verified at ground level.			
Required Verification Data: 1. A report on test results and an analysis showing compliance during functional testing. 2. Test Report and detailed analysis for items requiring more detailed corona test (if any).		Data Submittal Dates: 1. L-12 2. L-12	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: A revised analysis shall be performed for each configuration change where the bonding scheme is modified or when electrical drawings are modified. Measurements will be made of the bonding for new and refurbished assemblies prior to flight.		Reverification Method: A or A&T	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.		Data Submittal Dates: I. N/A II. L-12	
Applicable Document(s): MIL-STD-1686A SSP 57003, par. 3.2.2.4.5 and 3.2.2.4.8			

Appendix B Verification Definition Sheets

Number EL-019	Title ELECTRICAL – FIBER OPTIC CABLE CHARACTERISTICS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.4.4 High Rate Data Link Fiber Optic Cable (I)			
Requirement Summary: These requirements ensure that electrical and fiber-optic cables have specified characteristics.			
Detailed Descriptions of Requirements: Verification shall be by inspection of the Attached Payload to UMA HRDL cable. Verification shall be considered successful when an inspection shows that the Attached Payload to UMA HRDL cable meets SSQ 21654 or NASA approved equivalent			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.3.2.4.4 SSQ 21654			

Appendix B Verification Definition Sheets

Number EL-020	Title ELECTRICAL – POWER SWITCHES/CONTROLS	Method I, A&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.5.2 (A, B, C) Power Switches/Controls (I, A&T)			
<p>Requirement Summary:</p> <p>These requirements protect the ISS and its crew from accidents related to electrical shock. Power on/off switches/controllers must indicate when all electrical connections with the power supply are discontinued. If the power supply is not completely disconnected, then a crewmember should be able to determine this by examining the indicators. While in the power-off position, all power supply conductors (except the power return and grounding conductor) must be open (dead-faced).</p>			
<p>Detailed Descriptions of Requirements:</p> <p>Verification shall be by analysis and test of the Attached Payload switches/controls connected to Interface C performing on/off power functions. Verification shall be considered successful when the analysis and test confirm that the on/off functions open (dead-face) all supply circuit conductors except the power return and the equipment grounding conductor while in the power-off position.</p> <p>An analysis of the Attached Payload design drawings shall be performed to verify that power-off markings and/or indications are used only if all parts, with the exception of overcurrent devices and associated EMI filters, are disconnected from the supply circuit. Verification shall be considered successful when the analysis confirms the equipment has been met.</p> <p>Verification shall be by inspection. The Attached Payload design drawings shall be inspected to verify that standby, charging or other appropriate nomenclature was used to indicate that the supply circuit is not completely disconnected for this power condition.</p>			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
<p>I. On-orbit relocation of the Attached Payload: No reverification required.</p> <p>II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.</p>			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.2.2.5.2			

Appendix B Verification Definition Sheets

Number EL-021	Title ELECTRICAL – LRDL CABLING CHARACTERISTICS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.3.2.3 (A-B) LRDL Cabling (I)			
Requirement Summary: Attached Payload LRDL cables must meet SSQ 21655			
Detailed Descriptions of Requirements: Verification shall be by inspection of the UMA LRDL cable. Verification shall be considered successful when it is shown that the UMA LRDL cable meets SSQ 21655 or NASA approved equivalent. Verification shall be by inspection of the UMA LRDL cable. Verification shall be considered successful when the cable drawings are shown to require that the LRDL cable(s) cannot exceed 10 feet (30.7 meters).			
Required Verification Data: 1. Certificate of Compliance (COC).		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.3.2.3.2.3 SSQ 21655			

Appendix B Verification Definition Sheets

Number EL-022	Title ELECTRICAL – SAFETY REQUIREMENTS	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.5.1 Payload Electrical Safety (A) 4.3.2.2.5.1.2 Safety-Critical Circuits Redundancy (A)			
Requirement Summary: The AP must meet safety-critical circuits requirements.			
Detailed Descriptions of Requirements: Verification shall be by analysis. The analysis showing that the Attached Payload meets the requirements of NSTS 1700.7 ISS Addendum shall be submitted to the PSRP in accordance with NSTS 13830, Implementation Procedure for NSTS Payload System Safety Requirements. Verification shall be considered successful when hazard reports and safety data presented to the PSRP during the phased reviews are approved. Verification that the Attached Payload equipment connected to Interface C meets the loss of power safety requirements specified in NSTS 1700.7 ISS Addendum shall be performed and submitted to the PSRP in accordance with NSTS 13830. Verification shall be considered successful when hazard reports and safety data presented to the PSRP during the phased safety reviews are approved.			
Required Verification Data: 1. Certificate of Compliance (COC)		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. Same as the “Required Verification Data” identified above.		Data Submittal Dates: I. N/A II. TBD	
Applicable Document(s): SSP 57003 par. 3.2.2.5.1, 3.2.2.5.1.2 NSTS 13830, 1700.17 ISS Addendum			

Appendix B Verification Definition Sheets

Number EL-023	Title ELECTRICAL – CIRCUIT PROTECTION DEVICES	Method T, A, T&D	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.2.6.1 (A, B) International Space Station Electrical Power System Circuit Protection Characteristics (T, A) 4.3.2.2.2.6.2 Attached Payload Trip Ratings (T&D)			
Requirement Summary: Attached Payloads shall provide circuit protection devices.			
Detailed Descriptions of Requirements: <u>Interface C Compatibility</u> Tests shall be performed to show the Attached Payload connected to an Interface C electrical interface operates and is compatible with the characteristics shown and described in Figures 3.2.5-1 and paragraph 3.2.5 of SSP 57004, with the exception that the Auxiliary USL current-limiting and trip curve in Figure 3.2.5-1 applies to both the power feeds at S3/P3 Attach site locations. The tests shall be performed at initiation of power to the Attached Payload and with multiple internal load combinations. The verification shall be considered successful if the test results show the initial current flow, when powered on to the Attached Payload and current flow during the Attached Payload operations with multiple internal load does not exceed the current magnitude and duration as defined and described in SSP 57004 with the exception that the Auxiliary USL current-limiting and trip curve in Figure 3.2.5 -1 applies to both the power feeds at S3/P3 Attach site location. <u>Overcurrent Protection</u> Analysis of electrical circuit schematics shall be performed to show overcurrent protection exists at all points in the Attached Payload electrical architecture system where power is distributed to lower level (wire size not protected by upstream circuit protection device) feeder and branch lines. The analysis shall be considered successful when results show overcurrent protection exists at each point in the Attached Payload electrical architecture system where power is distributed to lower level (wire size) feeder and branch lines. <u>Payload Trip Ratings</u> The Attached Payload Trip Ratings shall be verified by test and demonstration. Input power to the Attached Payload shall be representative of the ISS power environment. The test and demonstration shall be performed as specified in SSP 57003, paragraph 4.3.2.2.2.6.1. The verification shall be considered successful when test and demonstration of the Attached Payload shows that the overcurrent which trips the circuit protection in a downstream device will not also trip the protection device upstream.			
Required Verification Data: 1. TBD		Data Submittal Dates: 1. TBD	
Description of Reverification Requirements:		Reverification Method:	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. TBD II. TBD		Data Submittal Dates: I. TBD II. TBD	
Applicable Document(s): SSP 57003, par. 3.2.2.2.6.1, 3.2.2.2.6.2 SSP 57004, par. 3.2.5, Figures 3.2.5-1			

Appendix B Verification Definition Sheets

Number EL-024	Title ELECTRICAL – LOSS OF POWER	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.3.3 Loss of Power (A)			
Requirement Summary: Attached Payloads must meet loss of power safety requirements.			
Detailed Descriptions of Requirements: Verification that the Attached Payload equipment connected to Interface C meets the loss of power safety requirements specified in NSTS 1700 ISS Addendum shall be performed and submitted to the PSRP in accordance with NSTS 13830. Verification shall be considered successful when hazard reports and safety data presented to the PSRP during the phased safety reviews are approved.			
Required Verification Data: 1. TBD		Data Submittal Dates: 1. TBD	
Description of Reverification Requirements:		Reverification Method: TBD	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. TBD II. TBD		Data Submittal Dates: I. TBD II. TBD	
Applicable Document(s): SSP 57003, par. 3.2.2.3.3 NSTS 1700 ISS Addendum NSTS 13830			

Appendix B Verification Definition Sheets

Number EL-025	Title ELECTRICAL – LOAD IMPEDANCES	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.2.2.7 Interface C Attached Payload Complex Load Impedance's (T)			
Requirement Summary: Attached Payloads must meet the amplitude and phase requirements as defined in SSP 57003.			
Detailed Descriptions of Requirements: Attached Payload load impedance shall meet the amplitude and phase requirements as specified in SSP 57003, Figure 3.2.2.2.7-1. If downstream devices can be shown to have negligible effect on load impedance magnitude and phase, or be realistically simulated by passive devices, then simulated loads may be used as downstream devices for test. Load impedance shall be tested under conditions of high, normal, and low voltage to the integrated Attached Payload system. The active converters directly downstream shall also be exercised through the complete range of their loading. Selected combinations of converters that can influence the measured load impedance at Interface C shall be tested. The verification shall be considered successful when the test shows that all load impedance's measured for high, nominal, and low voltage remain within specified limits.			
Required Verification Data: 1. Test Report		Data Submittal Dates: 1. L-12	
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.		Data Submittal Dates: I. N/A II. L-12	
Applicable Document(s): SSP 57003, par. 3.2.2.2.7 and Figure 3.2.2.2.7-1			

Appendix B Verification Definition Sheets

Number EL-026	Title ELECTRICAL – MCAS INTERFACE	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.2.1 Interface with Mobile Servicing System MCAS (T)			
Requirement Summary: Attached Payloads must meet the electrical interface requirements to receive power through the UMA simulator.			
Detailed Descriptions of Requirements: Verification of the Attached Payload to MCAS active UMA interface will be verified by test. The verification shall be considered successful when the test shows that the Attached Payload receives electrical power through the UMA simulator.			
Required Verification Data: 1. Certificate of Compliance (COC)			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, par. 3.2.1			

Appendix B Verification Definition Sheets

Number EL-027	Title ELECTRICAL –INTERFACE	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.1H Equipment Requiring Shuttle Robotic Support (I) 4.3.7.3.1G Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (I) 4.3.7.3.2C Equipment Requiring Space Station Remote Manipulator System Support using a Power Data Grapple Fixture (I)			
Requirement Summary: Attached Payloads must meet the electrical interface requirements.			
Detailed Descriptions of Requirements: Verification of the following shall be by inspection of the flight drawings to verify compliance with the requirements: 1). Attached Payloads requiring SRMS support shall electrically interface with the Grapple Fixture's ground strap whose length, gauge, and general outline are in accordance with NSTS 21000-IDD-ISS, paragraph 14.4.6 and SSP 30245, sections 3.2.1.3, 3.3, and 4.0. 2). Attached Payloads requiring SSRMS support shall electrically interface with the Grapple Fixture's in accordance with SSP 42004, section I3.2.2.5.1. 3). Attached Payloads requiring electrical power from the SSRMS shall interface with the PDGF in accordance with SSP 42004, paragraphs A3.2.2.5 and A3.2.2.5.2.			
Required Verification Data: 1. Certificate of Compliance (COC)		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): NSTS 21000-IDD-ISS, paragraph 14.4.6 SSP 30245, sections 3.2.1.3, 3.3, and 4.0. SSP 42004, paragraphs A3.2.2.5, A3.2.2.5.2 and I3.2.2.5.1 SSP 57003, par. 3.7.1, 3.7.3.1, 3.7.3.2.			

Appendix B Verification Definition Sheets

Number CD-001	Title C&DH – WORD/BYTE NOTATIONS, DATA TYPES, AND DATA TRANSMISSION	Method I&A&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.1.1 Word/Byte Notations (I&T) 4.3.3.2.2.1.1 CCSDS Data Packets (I&T) 4.3.3.2.1.2 Data Types (I) 4.3.3.2.2.1.1.1 CCSDS Primary Header (I&T) 4.3.3.2.1.3 (A,B) Data Transmissions (I) 4.3.3.2.2.1.1.2 (A, B) CCSDS Secondary Header (T) 4.3.3.2.2.1 (A, B) CCSDS Data (A or T)			
Requirement Summary: All data (low-, medium- and high-rate) must use specific formats for data transmission.			
Detailed Descriptions of Requirements: <u>Word/Byte Notations</u> Verification of the Attached Payload word/byte notations shall be by inspection and test. The inspection shall consist of a review of the word/byte notations against paragraph 3.1.1, Notations, of SSP 52050, Software Interface Control Document Part 1, International Standard Payload Rack to International Space Station, and paragraph 3.1.1, Data Bit/Byte Numbering Convention, of SSP 57002. Verification shall be considered successful when it is shown that the word/byte notations in the unique Attached Payload Software ICD conforms with paragraph 3.1.1, Notations, of SSP 52050 and paragraph 3.3.1, Data Bit/Byte Numbering Convention, of SSP 57002 and the Attached Payload communicates with the PRCU, STEP, or NASA approved equivalent.			
<u>Data Types</u> Verification of the Attached Payload data types shall be by inspection. The inspection shall consist of a review of the data types against paragraph 3.2.1 and subparagraphs, Data Formats, of SSP 52050. Verification shall be considered successful when it is shown that the data types in the unique Attached Payload software ICD conforms with paragraph 3.2.1 and subparagraphs, Data Formats, of SSP 52050.			
<u>Data Transmissions</u> A. Verification of the LRDL transmissions shall be by inspection. The inspection shall consist of a review of the LRDL data transmissions against paragraph 3.4, Non–Signal Data Coding Standards, of D684–10056–01. Verification shall be considered successful when it is shown that the word/byte notations in the unique payload software ICD conforms with SSP 52050, paragraph 3.1.2 Data Transmission and paragraph 3.4, Non–Signal Data Coding Standards, of D684–10056–01. B. Verification of the HRDL transmissions shall be by inspection. The inspection shall consist of a review of the HRDL data transmissions against paragraph 1.6, Bit Numbering Convention and Nomenclature, of CCSDS 701.0–B–2. Verification shall be considered successful when it is shown that the word/byte notations in the unique payload software ICD conforms with SSP 52050, paragraph 3.4.1 Signaling and paragraph 1.6, Bit Numbering Convention and Nomenclature, of CCSDS 701.0–B–2.			
<u>CCSDS Data</u> Verification of the Attached Payload CCSDS data that is transmitted from space to ground shall be by analysis or test. The analysis shall consist of a review of the CCSDS data in the software design documentation. The test shall consist of a data transmission with the PRCU, STEP or NASA approved EQUIVALENT and inspection of the transmitted data against the SSP 52050 formats. Analysis shall be considered successful when it is shown that in the software design documentation the Attached Payload data which is transmitted space to ground is either CCSDS data packets or CCSDS bitstream formats. Test shall be considered successful when the PRCU, STEP or NASA approved equivalent correctly receives the Attached Payload CCSDS data. Verification of the Attached Payload CCSDS data that is transmitted ground to space or from the S3/P3 Attach Sites to the Payload MDM shall be by analysis or test. The analysis shall consist of a review of the CCSDS data in the software design documentation. The test shall consist of a data transmission with the PRCU, STEP or NASA approved equivalent and inspection of the transmitted data against the SSP 52050 format. Analysis shall be considered successful when it is shown			

Appendix B Verification Definition Sheets

Number CD-001	Title C&DH – WORD/BYTE NOTATIONS, DATA TYPES, AND DATA TRANSMISSION	Method I&A&T	Hazard Report(s)
<p>that in the software design documentation the Attached Payload data which is transmitted ground to space or from the S3/P3 attach sites to the payload MDM are CCSDS data packets. Test shall be considered successful when the PRCU, STEP or NASA approved equivalent correctly receives the Attached Payload CCSDS data.</p> <p><u>Data Packets</u> Verification of the Attached Payload CCSDS data packet shall be by inspection and test. Inspection shall be considered successful when it is shown that the CCSDS data packets in the unique Attached Payload software ICD conforms with SSP 52050 and SSP 57002. Test shall be considered successful when the PRCU, STEP or NASA APPROVED equivalent correctly receives the Attached Payload CCSDS data packets.</p> <p><u>Primary Header</u> Verification of the Attached Payload CCSDS primary header shall be by inspection and test. The test shall consist of a data transmission with the PRCU, STEP or NASA approved equivalent and inspection of the transmitted data against the SSP 52050 formats. Test shall be considered successful when the PRCU, STEP or NASA approved equivalent correctly receives the Attached Payload CCSDS primary header.</p> <p><u>Secondary Header</u> A. Verification of the Attached Payload CCSDS secondary header shall be by test. The test shall consist of a data transmission with the PRCU, STEP or NASA approved equivalent and inspection of the transmitted secondary header immediately following the CCSDS primary header. Test shall be considered successful when the PRCU, STEP or NASA equivalent correctly receives the Attached Payload CCSDS secondary header. B. Verification of the Attached Payload CCSDS secondary header shall be by test. The test shall consist of a data transmission with the PRCU, STEP or NASA approved equivalent and inspection of the transmitted data against the SSP 52050 formats. Test shall be considered successful when the PRCU, STEP or NASA approved equivalent correctly receives the Attached Payload CCSDS secondary header.</p>			
Required Verification Data: 1. COC (PDL Submittal Completed) 2. COC (No changes since L-16) 3. COC (No changes since L-11) 4. COC for testing		Data Submittal Dates: 1. L-16 2. L-11 3. L-8 4. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.		Reverification Method: I&A&T	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-16/L-11/L-8/L-6	
Applicable Document(s): CCSDS 701.0-B-2, par. 1.6 D684-10056-01, par. 3.4 SSP 52050, par. 3.1.1, 3.1.2, 3.2,3.2.1, 3.3, 3.3.3.1, 3.4, and 3.4.1 SSP 57002, par. 3.1.1, 3.3.1 SSP 57003, par. 3.3.2.1.1, 3.3.2.2, 3.3.2.1.3, 3.3.2.2.1, 3.3.2.2.1.1, 3.3.2.2.1.1.1, 3.3.3.2.2.1.1.2			

Appendix B Verification Definition Sheets

Number CD-002	Title C&DH - CCSDS USER DATA FIELD	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.2.1.2 CCSDS Data Field (T)			
Requirement Summary: Data from the transmitting application to the receiving application must be in the CCSDS data field.			
Detailed Descriptions of Requirements: Verification of the Attached Payload CCSDS data field shall be by test. The test shall consist of a data transmission with the PRCU, STEP or NASA approved equivalent and inspection of the transmitted data against the SSP 52050 formats. Test shall be considered successful when the PRCU, STEP or NASA approved equivalent correctly receives the Attached Payload CCSDS data field.			
Required Verification Data: 1. COC for testing			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 52050 SSP 57003, par. 3.3.2.2.1.2			

Appendix B Verification Definition Sheets

Number CD-003	Title C&DH - CCSDS TIME CODES	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.2.1 CCSDS Unsegmented Time (T)			
Requirement Summary: The payload must have the ability to receive and process broadcast time.			
Detailed Descriptions of Requirements: Verification of the Attached Payload CCSDS unsegmented time shall be by test. The test shall consist of a data transmission with the PRCU, STEP or NASA approved equivalent and inspection of the transmitted data against the SSP 52050 formats. Verification shall be to test with the PRCU, STEP or NASA approved equivalent for correct test CCSDS unsegmented time at the UMA.			
Required Verification Data: 1. Certificate of Compliance (COC) for the test.			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: N/A	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: No reverification required			
Required Reverification Data: I. N/A II. N/A			Data Submittal Dates: I. N/A II. N/A
Applicable Document(s): SSP 52050 SSP 57003, par. 3.3.2.2.2.1			

Appendix B Verification Definition Sheets

Number CD-004	Title C&DH - LRDL PROTOCOL	Method I&A&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.3 (A,B) MIL-STD-1553B Low Rate Data Link (I&T) 4.3.3.2.3.1 MIL-STD-1553 Protocol (I&T) 4.3.3.2.3.1.1 (A, B) Standard Messages (I&T) 4.3.3.2.3.1.2 (A, B) Commanding (I&T)			
4.3.3.2.3.1.3 (A,B,C) Health and Status Data (A,I,T) 4.3.3.2.3.1.4 (A, B) Safety Data (T) 4.3.3.2.3.1.4.1.2 (A, B) Class 2-Warning (A&T) 4.3.3.2.3.1.4.1.3 (A, B) Class 3-Caution (A&T) 4.3.3.2.3.1.4.1.4 (A, B) Class 4-Advisory (A&T)			
Requirement Summary: The payload must have the ability to receive commands and data over the MIL-STD-1553B data bus.			
Detailed Descriptions of Requirements: <u>LRDL</u> A. Verify that there is a single MIL-STD-1553 Remote Terminal to the payload unique MIL-STD-1553 bus. B. Verify by inspection and test that each payload using the MIL-STD-1553B bus has the ability to receive data messages, (commands), and transmit data messages (standard messages, health and status data, and safety data). <u>Protocol</u> Verify by (1.) inspection that the MIL-STD-1553 protocol conforms with SSP 52050 and (2.) test that the PRCU, STEP, or equivalent correctly receives the Attached Payload data over the MIL-STD-1553. <u>Standard Messages</u> A. Verify by (1.) inspection that the CCSDS data packets in the unique Attached Payload software ICD conforms with paragraph 3.1.3, CCSDS Formats, of SSP 52050 and (2.) test that the PRCU, STEP, or equivalent correctly receives the Attached Payload CCSDS data packets. B. Verify by (1.) inspection that the CCSDS data packets in the unique Attached Payload software ICD conforms with Table 3.2.3.2.1.4-1 of SSP 52050 and (2.) test that the PRCU, STEP or equivalent correctly receives the Attached Payload CCSDS data packets. <u>Commanding</u> A. Verify by (1.) inspection that the command in the unique Attached Payload software ICD conforms with SSP 52050 and SSP 57002 and (2.) test that the PRCU, STEP, or equivalent correctly receives the Attached Payload commanding. B. Verify by (1.) inspection that the CCSDS data packets in the unique Attached Payload software ICD conforms with Table 3.2.3.2.1.4-1 of SSP 52050 and (2.) tests that the PRCU, STEP, or equivalent correctly receives the Attached Payload CCSDS data packets. <u>Health And Status Data</u> A. Verify by analysis that the requirements of SSP 52050, Section 3.2.3.5 have been met.			

Appendix B Verification Definition Sheets

Number	Title	Method	Hazard Report(s)
CD-004	C&DH - LRDL PROTOCOL	I&A&T	
<p>B. Verify by inspection that the format is developed in accordance with SSP 57002, Table A-5.</p> <p>C. Verify by test that the PRCU, STEP, or equivalent correctly receives the health and status data from the Attached Payload.</p> <p><u>Safety Data</u></p> <p>A. Verify by test that a transmission of a Health and Safety data CCSDS packets and an inspection of the received data for inclusion of Safety data shows that the PRCU, STEP, or equivalent correctly receive the safety data from the Attached Payload.</p> <p>B. Verify by test that a transmission of a Class 2, Class 3, and Class 4 Caution and Warning message and an inspection of the received data against the format of paragraph 3.2.3.5, Health and Status Data, of SSP 52050 and Table A-1, Telemetry Parameter Definition, and Table A-5, Health and Status ISS Processed Data Packets, of SSP 57002 shows that the PRCU, STEP, or equivalent correctly receives the safety data from the Attached Payload.</p> <p><u>Class 2-Warning</u></p> <p>A. Verify by (1.) analysis that the payload safety hazard reports and payload safety review data identifies the types of events identified as warnings (that could manifest to an emergency condition and automatic safing has safed the event) that are being monitored and shows the C&W word is formatted in accordance with paragraph 3.2.3.5, Health and Status Data, of SSP 52050 and (2.) test that the STEP, PRCU or equivalent determines that the C&W word in the Attached Payload's health and status is formatted as a warning for the events identified as warnings.</p> <p>B. Verify by (1.) analysis that the payload safety hazard reports and payload safety review data shall identify the types of events identified as warnings (that results in the loss of a hazard control and automatic safing has safed the event) that are being monitored and shows the C&W word is formatted in accordance with paragraph 3.2.3.5, Health and Status Data, of SSP 52050 and (2.) test that the STEP, PRCU or equivalent determines that the C&W word in the Attached Payload's health and status is formatted as a warning for the events identified as warnings.</p> <p><u>Class 3-Caution</u></p> <p>A. Verify by (1.) analysis that the payload safety hazard reports and payload safety review data identifies the types of events identified as caution (that could manifest to an emergency condition and automatic safing has safed the event) that are being monitored and shows the C&W word is formatted in accordance with paragraph 3.2.3.5, Health and Status Data, of SSP 52050 and (2.) test that the STEP, PRCU or equivalent determines that the C&W word in the Attached Payload's health and status is formatted as a caution for the events identified as caution.</p> <p>B. Verify by (1.) analysis that the payload safety hazard reports and payload safety review data shall identify the types of events identified as caution (that results in the loss of a hazard control and automatic safing has safed the event) that are being monitored and shows the C&W word is formatted in accordance with paragraph 3.2.3.5, Health and Status Data, of SSP 52050 and (2.) test that the STEP, PRCU or equivalent determines that the C&W word in the Attached Payload's health and status is formatted as a caution for the events identified as caution.</p> <p><u>Class 4-Advisory</u></p> <p>A. Verify by (1.) analysis that the payload safety hazard reports and payload safety review data identifies the types of events identified as advisory (that could manifest to an emergency condition and automatic safing has safed the event)</p>			

Appendix B Verification Definition Sheets

Number	Title	Method	Hazard Report(s)
CD-004	C&DH - LRDL PROTOCOL	I&A&T	
<p>that are being monitored and shows the C&W word is formatted in accordance with paragraph 3.2.3.5, Health and Status Data, of SSP 52050 and (2.) test that the STEP, PRCU or equivalent determines that the C&W word in the Attached Payload's health and status is formatted as a advisory for the events identified as advisory.</p> <p>B. Verify by (1.) analysis that the payload safety hazard reports and payload safety review data shall identify the types of events identified as advisory (that results in the loss of a hazard control and automatic safing has safed the event) that are being monitored and shows the C&W word is formatted in accordance with paragraph 3.2.3.5, Health and Status Data, of SSP 52050 and (2.) test that the STEP, PRCU or equivalent determines that the C&W word in the Attached Payload's health and status is formatted as a advisory for the events identified as advisory.</p>			
<p>Required Verification Data:</p> <ol style="list-style-type: none"> 1. Preliminary Certificate of Compliance (COC) for the inspection to ensure the conformance to the Unique Payload Software ICD. 2. Final COC for the inspection to ensure the conformance to the Unique Payload Software ICD. 3. Data Cert providing transmitted commands and received messages. 			<p>Data Submittal Dates:</p> <ol style="list-style-type: none"> 1. L-16 2 L-11 3. L-8
Description of Reverification Requirements:		Reverification Method: I&A&T	Hazard Report(s):
<p>I. On-orbit relocation of the Attached Payload: No reverification required.</p> <p>II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.</p>			
<p>Required Reverification Data:</p> <ol style="list-style-type: none"> I. N/A II. Same as the "Required Verification Data" identified above. 			<p>Data Submittal Dates:</p> <ol style="list-style-type: none"> I. N/A II. L-16/L-11/L-8
<p>Applicable Document(s):</p> <p>MIL-STD-1553B</p> <p>SSP 52050, Section 3.2.3.3.1 - 3.2.3.6</p> <p>SSP 57003, par. 3.3.2.3, 3.3.2.3.1, 3.3.2.3.1.1, 3.3.2.3.1.2, 3.3.2.3.1.3, 3.3.2.3.1.4, 3.3.2.3.1.4.1.2, 3.3.2.3.1.4.1.3, 3.3.2.3.1.4.1.4</p> <p>SSP 57002, Table A-5, A-13, A-14, A-15</p>			

Appendix B Verification Definition Sheets

Number CD-005	Title C&DH - LRDL MESSAGES	Method I&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.3.1.5 Service Requests (I&T) 4.3.3.2.3.1.6 Ancillary Data (I&T) 4.3.3.2.3.1.7 File Transfer (I&T) 4.3.3.2.3.1.8 Low Rate Telemetry (I&T)			
Requirement Summary: The payload that requires service requests, ancillary data, file transfers, and low-rate telemetry data must have the ability to request and receive these types of data.			
Detailed Descriptions of Requirements: Verify by inspection and test that each Payload requiring payload MDM services using the MIL-STD-1553B bus has the ability to request, respond to, and receive services from the Payload MDM. These services are defined in SSP 57003, Section 3.3.2.3.1.5 through 3.3.2.3.1.8. Inspection shall be considered successful when it is shown that the request and response for services is as shown in the tables of the Unique Payload Software ICD and conforms with SSP 52050 and SSP 57002. The test shall be considered successful when the PRCU, STEP or NASA approved equivalent, receives the Payload request for services and the Payload receives and processes the response correctly.			
Required Verification Data: 1. COC for the test.		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method: I	Hazard Report(s):
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): MIL-STD-1553B SSP 57003, par. 3.3.2.3.1.5, 3.3.2.3.1.6, 3.3.2.3.1.7, 3.3.2.3.1.8 SSP 57300 Software ICD Series Document SSP 57002 SSP 52050			

Appendix B Verification Definition Sheets

Number CD-006	Title C&DH - LRDL MODE CODES	Method I&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.3.1.10 Implemented Mode Codes (I&T)			
Requirement Summary: Data word counts and mode codes must follow a standard format.			
Detailed Descriptions of Requirements: Verify by inspection and test that each Payload using the MIL-STD-1553B bus has the data word count/mode code defined as specified in SSP 52050, Section 3.2.3.2.1.5. Inspection shall be considered successful when it is shown that the mode codes as shown in the tables of the unique payload software ICD agree with the mode codes defined as specified in SSP 52050, sections 3.2.3.2.1.5. The mode codes as specified in SSP 52050, section 3.2.3.2.1.5, which have "Yes" on the "required" column of the table, shall be tested with the PRCU or equivalent test equipment. The test shall be considered successful when the PRCU, STEP or NASA approved equivalent, receives the mode codes error free.			
Required Verification Data: 1. Certificate of Compliance (COC) for the test.		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): MIL-STD-1553B SSP 52050, section 3.2.3.2.1.5 SSP 57003, par. 3.3.2.3.1.10			

Appendix B Verification Definition Sheets

Number CD-007	Title C&DH - LRDL ILLEGAL COMMANDS ERROR	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.3.1.11 Illegal Commands (T)			
Requirement Summary: These requirements ensure that illegal commands will be detected.			
Detailed Descriptions of Requirements: Verify by test that each Payload using the MIL-STD-1553B bus has the capability of detecting Illegal Commands. The test, in accordance with an RT Validation Test Plan as defined in MIL-HBK-1553 Notice 1, Appendix A of the Attached Payloads Payload Bus Terminal, with the PRCU, STEP or NASA approved equivalent will be complete after the reception of an illegal command results in the setting of the message error bits in the Payload status word response.			
Required Verification Data: 1. Certificate of Compliance (COC) for the test.			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): MIL-STD-1553B SSP 57003, par. 3.3.2.3.1.11 MIL-HBK-1553			

Appendix B Verification Definition Sheets

Number CD-008	Title C&DH - LRDL SIGNAL CHARACTERISTICS	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.3.2.2 (A, B) LRDL Signal Characteristics (T)			
Requirement Summary: Attached Payload that requires connectivity to the payload local bus must have specific electrical and terminal characteristics.			
Detailed Descriptions of Requirements: Attached Payload which require connectivity to the payload local MIL-STD-1553B bus shall meet the characteristics in accordance with MIL-STD-1553B, paragraph 4.3. The Attached Payload MIL-STD-1553B terminal characteristics shall be in accordance with paragraph 4.5.2 of MIL-STD-1553B. Verification of the MIL-STD-1553B bus A and bus B shall be by test. Verification shall be to test the Attached Payload with the PRCU, STEP or NASA approved equivalent for correct test of the MIL-STD-1553B signal characteristics in accordance with paragraph 4.5.2 of MIL-STD-1553B with a MIL-STD-1553B bus analyzer as specified in MIL-HBK-1553B Handbook Notice 1, Appendix A, RT Validation Plan.			
Required Verification Data: 1. Certificate of Compliance (COC) for the test.			Data Submittal Dates: 1. L-11
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. Same as the "Required Verification Data" identified above II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: I. L-11 II. L-11
Applicable Document(s): MIL-HBK-1553B MIL-STD-1553B, par. 4.3 and 4.5.2 SSP 57003, par. 3.3.2.3.2.2			

Appendix B Verification Definition Sheets

Number CD-009	Title C&DH - LRDL CONNECTOR/PIN ASSIGNMENT	Method I&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.3.2.1 LRDL Connector/Pin Assignment (I&T)			
Requirement Summary: Attached Payload hardware must have accurate connector and pin assignments to interface properly.			
Detailed Descriptions of Requirements: Verification of the Attached Payload MIL-STD-1553B bus A connector and pin assignment shall be by inspection and test. Verification shall be by inspection of the UMA MIL-STD-1553B to the unique Attached Payload equipment hardware ICD against SSP 57004. Verification shall be to test with the PRCU, STEP or NASA approved equivalent for correct test of the MIL-STD-1553B to receive and execute commands at the UMA with various address assignments. Verification shall be by inspection of the UMA HRDL connector to mate with a test connector SSQ 21635, NATC07T15N4SN.			
Required Verification Data: 1. COC for the test.			Data Submittal Dates: 1. L-11
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: I. N/A II. L-11
Applicable Document(s): MIL-STD-1553B SSP 57004 SSP 57003, par. 3.3.2.3.2.1 SSQ 21635			

Appendix B Verification Definition Sheets

Number CD-010	Title C&DH - HRDL SIGNAL, SYMBOLS and ENCODING	Method I&A&T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.4.1 Payload to High Rate Frame Multiplexer Protocols (I&T) 4.3.3.2.4.2.1 Physical Signaling (T&A) 4.3.3.2.4.2.2 Encoding (I&T) 4.3.3.2.4.2.3 Symbols Used In Testing (T)			
Requirement Summary: These requirements define the Attached Payload HRDL interface characteristics			
Detailed Descriptions of Requirements: A. Verification of the Attached Payload High Rate Frame Multiplexer (HRFM) Protocol shall be by inspection and test. Verification shall be considered successful when it is shown that the Attached Payload complies with SSP 50184. Test shall be considered successful when the Attached Payload correctly communicates with the Payload MDM. B. Verification of the Attached Payload HRDL physical signaling shall be by test and analysis. Verification of the fiber optic transmitted waveform at the fiber optic transmitter component of the Attached Payload shall be by test at the UMA. Verification of the fiber optic receiver sensitivity and bit error rate (BER) shall be by test of the fiber optic receiver component of the Attached Payload at the UMA. Verification of the UMA fiber optic receiver sensitivity and BER is by analysis. BER is required of the receiver per the ANSI X3.255.1996 test. C. Verification of the Attached Payload HRDL encoding shall be by inspection and test. Verification shall be by inspection of the UMA HRDL protocol to the unique Attached Payload hardware at the UMA against SSP 50184 and SSP 57004. Verification shall be to test the UMA with the PRCU, STEP or equivalent for correct test of the HRDL protocol. D. Verification shall be by test in accordance with SSP 57003, par. 4.3.3.2.4.3.1, HRDL transmitted optical powers at the UMA.			
Required Verification Data: 1. Data Cert. providing rates, signal coding, and control signals. 2. Certificate of Compliance (COC) for signal coding and control signal.			Data Submittal Dates: 1. L-16 2. L-8
Description of Reverification Requirements:		Reverification Method: I&A&T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): ANSI X3.255 SSP 50184 SSP 57004 SSP 57003, par. 3.3.2.4.1, 3.3.2.4.2.1, 3.3.2.4.2.2, 3.3.2.4.2.3, 3.3.2.4.3.1			

Appendix B Verification Definition Sheets

Number CD-011	Title C&DH - HRDL SEND/RECEIVE OPTICAL POWER	Method T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.4.3.1 High Rate Data Link Transmitted Optical Power (T) 4.3.3.2.4.3.2 High Rate Data Link Received Optical Power (T)			
Requirement Summary: These requirements ensure that transmitted and received optical power falls within a specified range.			
Detailed Descriptions of Requirements: Verification of transmitted optical power shall be to test with fiber optic power meter per ANSI X3.255–1996, for correct optical power at the UMA using the Halt symbol. The optical power perturbations from the test setup are not included in the stated power requirement. The perturbations from the test are to be documented. Verification of received optical power shall be to test at the UMA with a calibrated fiber optic source using the Halt symbol at the minimum power. The optical power perturbations from the test setup are not included in the stated power requirement. The perturbations from the test are to be documented. These tests shall be considered successful when the requirement is met or exceeded after the test setup variations are removed from the result.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC.			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): ANSI X3.255 SSP 57003, par. 3.3.2.4.3.1 & 3.3.2.4.3.2			

Appendix B Verification Definition Sheets

Number	Title	Method	Hazard Report(s)
CD-012	C&DH – PORTABLE COMPUTER SYSTEM	A	
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.2.5 Portable Computer System (A)			
<p>Requirement Summary:</p> <p>This requirements ensures that Payload Laptops provided by the Payload Developers and used to provide experiment control and display, properly interfaces and does not interfere with other space station operations.</p>			
<p>Detailed Descriptions of Requirements:</p> <p>The Portable Computer System is not supported at the S3/P3 attach sites, therefore those Attached Payloads who desire to utilize the Portable Computer System shall interface remotely through MIL-STD-1553 in accordance with the requirements defined in the Pressurized Payload Interface Requirements Document, SSP 57000, paragraphs 3.3.8.2 and 3.3.8.2.1. Verification by analysis shall be considered successful when the analysis shows that the requirements defined in SSP 57000, paragraphs 3.3.8.2 and 3.3.8.2.1 are met.</p>			
<p>Required Verification Data:</p> <ol style="list-style-type: none"> 1. COC (PDL Submittal Completed) 2. COC (No changes since L-16) 3. COC (No changes since L-11) 			<p>Data Submittal Dates:</p> <ol style="list-style-type: none"> 1. L-16 2. L-11 3. L-8
Description of Reverification Requirements:		Reverification Method:	Hazard Report(s):
		A	
<p>I. On-orbit relocation of the integrated rack: No reverification required.</p> <p>II. On-orbit subrack PL change out (new, re-flight, or series) of the integrated rack: Same as the "Detailed Descriptions of Requirements" identified above.</p>			
<p>Required Reverification Data:</p> <p>I. N/A</p> <p>II. COC</p>			<p>Data Submittal Dates:</p> <p>I. N/A</p> <p>II. L-16/L-11/L-8</p>
<p>Applicable Document(s):</p> <p>MIL-STD-1553</p> <p>SSP 57000, par. 3.3.8.2 and 3.3.8.2.1</p> <p>SSP 57003, par. 3.3.2.5</p>			

Appendix B Verification Definition Sheets

Number	Title	Method	Hazard Report(s)
CD-013	C&DH – MSS INTERFACE	T	
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.3.1 Command and Data Handling Interface with Mobile Servicing System (T)			
Requirement Summary: This requirement ensures that Attached Payload can transmit and receive data from the ISS while positioned On the MCAS.			
Detailed Descriptions of Requirements: Verification of the Attached Payload interface to the UMA shall be by test. Verification shall be considered successful when the test shows that the Attached Payload can transmit and receive data from the ISS in accordance with SSP 42004, paragraph B3.2.2.6.			
Required Verification Data: 1. Certificate of Compliance (COC) for the test.			Data Submittal Dates: 1. L-8
Description of Reverification Requirements:		Reverification Method: T	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required.			
II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC for the test			Data Submittal Dates: I. N/A II. L-8
Applicable Document(s): SSP 57003, par. 3.3.1 SSP 42004, par. B3.2.2.6.			

Appendix B Verification Definition Sheets

Number CD-014	Title C&DH – DATA/VIDEO	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.3.2 (E-F) Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (I)			
Requirement Summary: Attached Payloads requiring data and video interface with the PDGF shall meet the specified requirements.			
Detailed Descriptions of Requirements: Verification of the Attached Payload data and video Payload Data Grapple Fixture interface shall be verified by inspection of the flight drawings. Inspection shall show that data from the SSRMS interfaces with the PDGF in accordance with SSP 42004, section A3.2.2.6 and that the video interface with the SSRMS and PDGF is in accordance with SSP 42004, section A3.2.2.7.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the “Detailed Descriptions of Requirements” identified above.			
Required Reverification Data: I. N/A II. COC.			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SSP 57003, 3.7.3.2 SSP 42004, A3.2.2.6 and A3.2.2.7			

Appendix B Verification Definition Sheets

Number EN-001	Title ENVIRONMENTAL - EXTERNAL CONTAMINATION	Method A, T	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.5.1.5.1 Molecular Column Density from Venting, Leakage and Outgassing (A) 4.3.5.1.5.2 (A&B) Molecular Deposition from Materials Outgassing and Venting (T&A)			
Requirement Summary: Attached Payload Environmental interface requirements			
Detailed Descriptions of Requirements: An analysis shall be performed using Attached Payload design data and operational conditions to determine molecular column densities for individual species. Verification shall be considered successful when the analysis shows that the molecular column densities produced by the Attached Payload do not exceed $1 \times 10^{+14}$ molecules/cm ² for any individual species, when viewed from any other Attached Payload location. The vent axis will be oriented to preclude direct plume impingement on other Attached Payloads. Outgassing testing shall be performed of the Attached Payload component materials exposed to space vacuum and one used in quantities greater than 0.1 m ² surface area per guidelines established in ASTM E 1559. The test shall be of long duration (144 hours minimum). The materials samples (emitters) shall be tested at their nominal operating temperature. During the ASTM E 1559 testing, one QCM will be maintained at -40°C; one QCM will be maintained at +25°C; and one QCM will be maintained at a temperature between -40°C and +25°C. Verification shall be considered successful when the Attached Payload demonstrates by analysis that cumulative contaminant deposits do not exceed 1×10^{-14} gm/cm ² /sec on other Attached Payloads. Outgassing testing shall be performed of the Attached Payload component materials exposed to space vacuum and are used in quantities greater than 0.1 m ² surface area per guidelines established in ASTM E 1559. The test shall be of long duration (144 hours minimum). The materials samples (emitters) shall be tested at their nominal operating temperature. During the ASTM E 1559 testing one QCM will be maintained at -40°C; one QCM will be maintained at +25°C; and one QCM will be maintained at a temperature between -40°C and +25°C. Verification shall be considered successful when the Attached Payload demonstrates by analysis that contaminant deposits do not exceed 1×10^{-15} gm/cm ² /sec on ISS element external contamination sensitive surfaces.			
Required Verification Data: 1. Data Cert. providing the required outgassing characteristics including materials, locations, surface area, outgassing rate, and temperature. 2. Data Cert. providing the required venting characteristics including mass flow rate, composition (effluents), blowdown curves, temperature, plume model and pressure 3. Updated Data Cert. (if required)			Data Submittal Dates: 1. L-20 2. L-20 3. L-12
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method: A&I	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): ASTM-E-1559 SSP 30426, par. 3, 4, 3.5 SSP 57003, par. 3.5.1.5.1, 3.5.1.5.2			

Appendix B Verification Definition Sheets

Number EN-002	Title ENVIRONMENTAL - IONIZING RADIATION DOSE	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.5.1.8.1 Attached Payload Contained or Generated Ionizing Radiation (A) 4.3.5.1.8.2 Ionizing Radiation Dose (A) 4.3.5.1.8.3 Nominal Single Event Effects Ionizing Radiation (A) 4.3.5.1.8.4 Extreme Single Event Effects (A) 4.3.8.4.4 Power Sources (A)			
Requirement Summary: Equipment and subsystems must not produce an unsafe condition as a result of generating or exposure to ionizing environment or one that could cause damage to equipment external to payload.			
Detailed Descriptions of Requirements: Verification that equipment and subsystems are designed to not produce an unsafe condition or one that could cause damage to equipment external to the payload as a result of generating or exposure to ionizing radiation shall be by analysis. An analysis of equipment and subsystems shall be performed using the operational lifetime and parts characterization data to assure that the design meets the requirement when generating or exposed to ionizing radiation. The verification shall be considered successful when the analysis shows that the equipment and subsystems will not produce an unsafe condition or one that could cause damage to equipment external to the payload when generating or exposed to the specified environment.			
Required Verification Data: 1. Data Cert. providing the analysis results.			Data Submittal Dates: 1. L-12
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method: A	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: I. N/A II. L-12
Applicable Document(s): SSP 30512 SSP 57003, par. 3.5.1.8.1, 3.5.1.8.2, 3.5.1.8.3, 3.5.1.8.4, 3.8.4.4			

Appendix B Verification Definition Sheets

Number EN-003	Title ENVIRONMENTAL - MICROGRAVITY	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.1.3.2.6 Microgravity (TBD) 4.3.1.3.2.6.1 Limit Quasi-Steady Accelerations (TBD) 4.3.1.3.2.6.2 Limit Vibratory and Transient Accelerations (TBD)			
Requirement Summary: TBD			
Detailed Descriptions of Requirements: TBD			
Required Verification Data: 1. TBD			Data Submittal Dates: 1. TBD
Description of Reverification Requirements:		Reverification Method: TBD	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. TBD			Data Submittal Dates: I. N/A II. TBD
Applicable Document(s): SSP 57003, par. 3.1.3.2.6, 3.1.3.2.6.1, 3.1.3.2.6.2			

Appendix B Verification Definition Sheets

Number MP-001	Title MATERIALS - CLEANLINESS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.6.3 Cleanliness (I)			
Requirement Summary: Attached Payload external surfaces must be inspected to verify meeting SN-C-0005 Rev C			
Detailed Descriptions of Requirements: Verification that Attached Payload hardware external surfaces conform to visibly clean-standard cleanliness requirements as specified in SN-C-0005 shall be by inspection. An inspection of the hardware as specified in SN-C-0005 shall be performed to show that the Attached Payload hardware meets the visibly clean-standard requirement. Verification shall be considered successful when the inspection shows the Attached Payload hardware external surfaces meets the requirements for visibly clean-standard specified in SN-C-0005.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): SN-C-0005 SSP 57003, par. 3.6.3			

Appendix B Verification Definition Sheets

Number MP-002	Title MATERIALS - COMMERCIAL PARTS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.6.2 Commercial Parts (I)			
Requirement Summary: Commercial parts used by Attached Payloads must meet NSTS 1700.7B ISS Addendum			
Detailed Descriptions of Requirements: Verification that COTS parts meet the requirements of NSTS 1700.7B ISS Addendum shall be performed and submitted to the PSRP in accordance with NSTS 13830. Verification shall be considered successful when COTS parts are shown to meet the requirements of NSTS 1700.7B ISS Addendum.			
Required Verification Data: 1. Certificate of Compliance (COC).			Data Submittal Dates: 1. L-6
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): NSTS 13830 NSTS 1700.7B ISS Addendum SSP 57003, PAR. 3.6.2			

Appendix B Verification Definition Sheets

Number MP-003	Title MATERIALS - SURFACE MATERIALS	Method I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.6.1.1 Thermal Vacuum Stability (I)			
Requirement Summary: The Attached Payload and PD-provided ancillary equipment surface materials must meet the specified thermal vacuum stability requirements when tested per ASTM-E-595			
Detailed Descriptions of Requirements: Verification that Attached Payload non-metallic materials are tested per ASTM-E-595 shall be by inspection. The verification shall be considered successful when the payload developer certifies that all materials meet the requirements of ASTM-E-595.			
Required Verification Data: 1. Preliminary Data Cert. providing all of the surface materials to the Materials Working Group for approval. 2. Final Data Cert. providing all of the surface materials and thermal vacuum stability data to the Materials Working Group for approval, (additional updates as required).			Data Submittal Dates: 1. L-20 2. L-12
Description of Reverification Requirements:		Reverification Method: I	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: I. N/A II. COC			Data Submittal Dates: I. N/A II. L-6
Applicable Document(s): ASTM-E-595 SSP 57003, par. 3.6.1.1			

Appendix B Verification Definition Sheets

Number TC-001	Title THERMAL-EXTERNAL TOUCH TEMPERATURE	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.8.4.1.1 Incidental Contact (A) 4.3.8.4.1.2 Unlimited Contact (A)			
Requirement Summary: Attached Payloads must design to support Crewmember touch temperatures.			
Detailed Descriptions of Requirements: <u>Incidental Contact</u> An analysis shall be performed using data from drawings, thermal analyses, tests, and operational procedures to identify hardware whose temperature exceed -180 degrees F to +235 degrees F and have potential for incidental contact by EVA crewmembers. The analysis shall determine contact surface temperatures and average heat transfer rates at EVA interfaces. For the purposes of this analysis, a boundary node with the appropriate temperature listed in Table 3.8.4.1.1-1 is connected with linear conductor to a 42.75 in squared surface of the objects exposed area overlaying the contact node. The contact node, an adiabatic surface except for contact with the boundary node, shall have a surface area of 42.75 in squared and shall have a non-zero thermal capacitance value. Analysis shall show that heat transfer rates do not exceed rates specified in Table 3.8.4.1.1-1. Verification shall be considered successful when the analysis shows that equipment temperatures and heat rates shall not pose a hazard to the suited EVA crewmember. <u>Unlimited Contact</u> An analysis shall be performed using data from drawings, thermal analyses, tests, and operational procedures to identify hardware whose temperature exceed -45 degrees F to + 145 degrees F for potential unlimited contact by EVA crewmembers. The analysis shall determine contact surface temperatures and average heat transfer rates at EVA interfaces. For the purposes of this analysis, a boundary node with the appropriate temperature listed in Table 3.8.4.1.2-1 is connected with linear conductor to a 42.75 inches square surface of the objects exposed area overlaying the contact node. The contact node, an adiabatic surface except for contact with the boundary node, shall have a surface area of 42.75 inches square and shall have a non-zero thermal capacitance value. Analysis shall show that heat transfer rates do not exceed rates specified in Table 3.8.4.1.2-1. Verification shall be considered successful when the analysis shows that equipment temperatures and heat rates shall not pose a hazard to the suited EVA crewmember.			
Required Verification Data: 1. Certificate of Compliance		Data Submittal Dates: 1. L-6	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method:	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the "Detailed Descriptions of Requirements" identified above.		Data Submittal Dates: I. N/A II. L-6	
Applicable Document(s): SSP 57003, par. 3.8.4.1.1, 3.8.4.1.2, Table 3.8.4.1.1-1, 3.8.4.1.2-1			

Appendix B Verification Definition Sheets

Number TC-002	Title THERMAL-INTERFACES	Method A, I	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.7.1I Equipment Requiring Shuttle Robotic Support (I) 4.3.7.3.1F Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture (I) 4.3.7.3.2H Equipment Requiring SSRMS Support Using Power Data Grapple Fixture (A)			
Requirement Summary: Attached Payloads must account for thermal interfaces			
Detailed Descriptions of Requirements: THERMAL ISOLATION An Attached Payload requiring SRMS support shall provide thermal isolation between the payload and the GF by installing the thermal isolation washers and bushings provided with the GF in accordance with NSTS 21000-IDD-ISS, Figure 14.4.7.4-1. An Attached Payload requiring SSRMS support using a NSTS GF shall provide thermal isolation between the payload and the GF by installing the thermal isolation washers and bushings provided with the GF in accordance with NSTS 21000-IDD-ISS, Figure 14.4.7.4-1. This requirement shall be verified by inspection of flight drawings. The verification shall be considered successful when the inspection shows compliance with the requirements as specified. THERMAL CONDUCTANCE Attached Payload Equipment Requiring SSRMS Support Using a PDGF shall limit the thermal conductance from the payload to the PDGF in accordance with SSP 42004, paragraph A3.2.2.8.1. This requirement shall be verified by analysis. The verification shall be considered successful when the analysis shows compliance with the requirement as specified.			
Required Verification Data: 1. Preliminary Analysis Report 2. Final Analysis Report		Data Submittal Dates: 1. L-20 2. L-12	
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method:	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.		Data Submittal Dates: I. N/A II. Same as the original submittal dates	
Applicable Document(s): NSTS 21000-IDD-ISS, fig. 14.4.7.4-1 SSP 42004, par. A3.2.2.8.1 SSP 57003, par. 3.7.1I, 3.7.3.1F, 3.7.3.2H			

Appendix B Verification Definition Sheets

Number TC-003	Title THERMAL-DESIGN	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.4.1.1 Passive Thermal Control Design Requirements For Payload On Integrated Truss Segment S3 Payload Attach System and P3 Unpressurized Cargo Carrier Attach System (A) 4.3.4.1.1.1 Temperature Requirement (A) 4.3.4.1.1.3 Incident Solar Energy (A)			
Requirement Summary: AP must meet ISS passive thermal design requirements.			
Detailed Descriptions of Requirements: <u>Passive Thermal</u> Verification shall be by analysis. Verification shall be considered successful when the analysis shows that the Attached Payload passive thermal control analysis is in accordance with S3 thermal math model in D684-10058-03-01. <u>Temperature</u> Verification shall be by analysis. The analysis shall show that the Attached Payload to S3 PAS and P3 UCCAS meets all requirements when the interface temperature is between -120 degrees Fahrenheit (F) and +200 degrees F. <u>Solar Energy</u> Verification shall be by analysis. The Attached Payload developer shall calculate the total solar energy, including direct solar radiation, reflected solar radiation, and albedo, which is reflected off the payload and incident on the ISS. This calculation shall be based on the ISS integrated geometric math (TRASYS) model. Verification is considered to be successful when the orbital average solar energy reflected from the payload to the ISS is demonstrated to be no greater than the allowable maximum.			
Required Verification Data: 1. Preliminary Analysis Report 2. Final Analysis Report			Data Submittal Dates: 1. L-20 2. L-12
Description of Reverification Requirements: I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.		Reverification Method: A	Hazard Report(s):
Required Reverification Data: I. N/A II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: I. N/A II. Same as the original submittal dates
Applicable Document(s): SSP 57003, par. 3.4.1.1, 3.4.1.1.1, 3.4.1.1.3			

Appendix B Verification Definition Sheets

Number TC-004	Title THERMAL-RADIATION	Method A	Hazard Report(s)
SSP 57003 Section 4 Number(s), Title(s), and Method(s): 4.3.4.1.1.4 Heat Radiation (A)			
Requirement Summary: Attached Payloads must account for thermal radiation			
Detailed Descriptions of Requirements: HEAT RADIATION Verification shall be by analysis. The Attached Payload developer shall calculate the total thermal energy emitted by the payload that is incident on the ISS. The total thermal radiation emitted from the payload to the ISS shall be calculated by summing the radiation from each individual exterior surface of the payload. The payload temperature and the form factors from the payload to the ISS shall be calculated using the ISS integrated geometric math (TRASYS) model and ISS integrated thermal math (SINDA) model. Verification is considered to be successful when the orbital average thermal radiation emitted from the payload to the ISS is demonstrated to be no greater than the allowable maximum.			
Required Verification Data: 1. Preliminary Analysis Report 2. Final analysis report			Data Submittal Dates: 1. L-20 2. L-12
Description of Reverification Requirements:		Reverification Method:	Hazard Report(s):
I. On-orbit relocation of the Attached Payload: No reverification required. II. On-orbit change out (new, re-flight, or series) of the Attached Payload: Same as the "Detailed Descriptions of Requirements" identified above.			
Required Reverification Data: II. N/A II. Same as the "Required Verification Data" identified above.			Data Submittal Dates: I. N/A II. Same as the original submittal dates
Applicable Document(s): SSP 57003, par. 3.4.1.1.4			

(This Page Intentionally Left Blank)

APPENDIX C
EXAMPLE SUBMITTAL FORMS

Certificate of Compliance (COC)

I hereby certify compliance with the verification requirements as specified in _____. I also certify that the identified as-built hardware, per the current applicable Engineering Configuration List, was manufactured in accordance with the design drawings, parts lists, applicable waivers and deviations. All supporting data is valid, applicable, and complete. This data is maintained in our files and will be made available upon request.

Payload	VDS Number	Method	Applicable Document Rev. Date	Drawings, Parts Lists, Waivers, Deviations, Procedures, Etc. (Attach correlated list as needed)

Print Name/Signature/Date

Payload Developer Responsible Person

Organization

Certificate of Compliance (COC)**For Command and Data Handling (C&DH) Data Set Inputs into the Payload Data Library (PDL)**

I hereby certify that the Command and Data Handling (C&DH) data sets have been entered into the Payload Data Library (PDL) and that those data sets are complete and ready for flight. Any incomplete data is as identified below in the Comments column. If there is no incomplete data, enter "None" in the Comments column.

Payload	Completion Date for PDL Inputs	VDS Number	Applicable Document Rev/Date	Comments (Identification of Incomplete Data)

Print Name/Signature/Date

Payload Developer/Integrator Responsible Person

Organization

Data Certification

I hereby certify compliance with the verification requirements as specified in _____. I also certify that the identified as-built hardware, per the current applicable Engineering Configuration List, was manufactured in accordance with the design drawings, parts lists, applicable waivers and deviations. All supporting data is valid, applicable, and complete. This data is maintained in our files and will be made available upon request.

Payload	VDS Number	Method	Applicable Document Rev. Date	Completion Date	Summary (attach sheets as needed)

Print Name/Signature/Date

Payload Developer Responsible Person

Organization

VERIFICATION ANALYSIS REPORT			
Payload:	Analyst:	Configuration analyzed:	Date:
1. Objective of the Analysis:			
2. Requirements Satisfied:			
3. Description of Analytical Technique:			
4. Analysis Input Data (Summary):			
5. Technical Results:			
6. Conclusions:			
7. Signature and Organization			

VERIFICATION TEST REPORT			
Payload:	Test Engineer:	Test Procedure Used:	Date:
1. Item Tested (Name, Serial Number, Part Number):			
2. Objectives of the Test:			
3. Description of Test Setup:			
4. Test Results Summary:			
5. Correlation of Test Sequence to Verification Requirements:			
6. Explanation of all Failures and Corrective Action Taken during the Test:			
7. Signature and Organization		8. Quality Assurance:	

(This Page Intentionally Left Blank)

APPENDIX D
HUMAN FACTORS VDS CANDIDATE LIST NOT REQUIRING ANALYSIS FOR VERIFICATION

The following is a tentative list of the requirements that are proposed for crew review as a verification option.

VDS Number	IRD Section 3 Requirement	IRD Requirement Title	Date Reviewed	Astronaut Office Acceptance Date
ME-007	3.8.4.2.3	Holes		
ME-007	3.8.4.2.3.1	Handrails/Holds		
ME-007	3.8.4.2.4	Pinch Points		
ME-007	3.8.4.2.5	Protective Covers for Portable Equipment		
ME-007	3.8.4.2.6.2	Protective Covers or Guards		
ME-007	3.9.1.7.5 (A,G,H)	Covers		
ME-008	3.8.3.2.2	Extravehicular Activity Actuated Controls		
ME-008	3.8.4.2.9	Levers, Cranks, Hooks and Controls		
ME-008	3.9.1.1.1.E	Manual Failure Detection, Isolation, and Recovery		
ME-013	3.8.3.1.1.1 (A,B)	Centering		
ME-013	3.9.1.6.6.1	Direction of Removal		
ME-013	3.9.1.6.6.2	Visibility		
ME-017	3.9.1.7.3	Connectors		
ME-017	3.9.1.7.3.1.A	One-Handed Operation		
ME-018	3.9.1.7.3.1.B	One-Handed Operation		
ME-018	3.9.1.7.3.3 (A,B)	Connector Arrangement		
ME-018	3.9.1.7.3.7.1 (A,B)	Spacing		
ME-020	3.9.1.6.6.3 (A,B,C)	Mounting Alignment		
ME-020	3.9.1.7.2 (A,B)	Payload Hardware and Equipment Mounting		
ME-020	3.9.1.7.3.5 (A,B)	Coding		
ME-020	3.9.1.7.3.7	Orientation		
ME-021	3.8.2.2	Extravehicular Activity Translation Corridor Protrusion		
ME-021	3.8.3.3.1.3.B	Mounted Clearance		
ME-021	3.8.4.2	Equipment Clearance for Entrapment Hazards		
ME-022	3.9.1.7.4. (A,B,C)	Cable Restraints		
ME-023	3.9.1.7.5.C	Covers		
ME-023	3.9.1.7.3.3.1	Status		
ME-023	3.9.1.7.6.1 (A,B)	Equipment Status Indication		
ME-024	3.9.1.7.1.1 (A,B,C)	Tool Clearance		
ME-024	3.9.1.7.6.3 (A,B,C)	Fasteners Clearances		
ME-024	3.9.2.2.6.1	Extravehicular Activity Access to Fasteners		
ME-025	3.8.4.2.7.1	Screws and Bolts		
ME-025	3.8.4.2.7.2	Securing Pins		
ME-025	3.8.4.2.8	Safety Critical Fasteners		
ME-025	3.9.1.7.6	Fasteners		
ME-025	3.9.1.7.6.5 (A,B)	Captive Fasteners		
ME-025	3.9.1.7.6.6 (A,B)	Quick Release Fasteners		
ME-025	3.9.1.7.6.9 (A,B)	Contingency Override		
ME-026	3.8.4.2.6.1 (A,B,C,D,E)	Design		
ME-026	3.9.1.7.6.7 (A,B,C)	Over Center Latches		
ME-027	3.9.1.7.6.8 (A,B)	Fastener Heads and Knobs		

VDS Number	IRD Section 3 Requirement	IRD Requirement Title	Date Reviewed	Astronaut Office Acceptance Date
ME-028	3.8.3.3.1.5.B	Non-Fixed Handles Design		
ME-028	3.9.1.6.1	Method		
ME-028	3.9.1.7.6.2	One-Handed Actuation		
ME-029	3.9.1.7.7.1.B	Contingency Extravehicular Activity Controls		
ME-030	3.8.3.3.1.5.C	Non-Fixed Handles Design		
ME-030	3.9.1.7.7.1.A	Contingency Extravehicular Activity Controls		
ME-031	3.8.3.3.2.1 (A,B,C)	Tether Attachment Points		
ME-032	3.8.3.3	Mobility Aids and Restraints		
ME-032	3.8.3.3.1.6	Handrails/Handhold Tether Attachment		
ME-032	3.8.3.3.2	Extravehicular Activity Safety Tethers and Safety Hooks		
ME-032	3.8.4.2.7	Captive Parts		
ME-032	3.8.4.2.7.3	Locking Wires		
ME-032	3.9.1.5	Access Item Retainment		
ME-032	3.9.1.7.5.F	Covers		
ME-032	3.9.2.2.A	On-Orbit Maintenance		
ME-033	3.9.1.5.1	Captive Parts		
ME-034	3.8.3.3.1	Provide Extravehicular Activity Handles		
ME-034	3.8.3.3.1.1 (A,B)	Extravehicular Activity Handholds/Handrails		
ME-034	3.8.3.3.1.2	Dimensions		
ME-034	3.8.3.3.1.3 (A,C)	Mounted Clearance		
ME-034	3.8.3.3.1.4.B	Positioning/Location		
ME-035	3.8.3.3.1.4.C	Positioning/Location		
ME-037	3.8.3.3.1.7	Danger Warnings		
ME-037	3.8.3.5	Location Coding		
ME-037	3.9.1.7.7.3	Labeling		
ME-037	3.10 (A, B)	Nameplates and Product Marking		
ME-038	3.8.3.1	Crew Access Dimensions		
ME-038	3.8.3.1.1	Body Envelope and Reach Accessibility		
ME-038	3.8.3.3.1.4.A	Positioning/Location		
ME-038	3.8.3.4.1	Extravehicular Activity Gloved Hand Access		
ME-038	3.9.1.3 (A, B, C, D)	Access		
ME-038	3.9.1.7.5.E	Covers		
ME-038	3.9.2.2.6	Access for On-Orbit Maintenance		
ME-039	3.9.1.1.1.B	Manual Failure Detection, Isolation, and Recovery		
ME-040	3.9.1.1.1.C	Manual Failure Detection, Isolation, and Recovery		
ME-041	3.9.1.1.1.A	Manual Failure Detection, Isolation, and Recovery		
ME-041	3.9.1.7.7.2 (A, B)	Displays		
ME-043	3.8.3.3.1.8	Color		
ME-047	3.9.1.7.A	Standard Extravehicular Activity / Extravehicular Robotics Interfaces		
ME-048	3.8.4.2.1.1	Sharp Edges		
ME-048	3.8.4.2.1.1.1(A, B, C, D)	Exposed Edge Requirements		
ME-048	3.8.4.2.1.1.2(A, B)	Exposed Corner Requirements		
ME-048	3.8.4.2.1.2	Thin Materials		
ME-048	3.8.4.2.2	Burrs		
ME-049	3.8.3.1.1.2	Extravehicular Activity Crew Member Field of View		

APPENDIX E
MICROGRAVITY CONTROL PLAN

(TBD)

(This Page Intentionally Left Blank)

APPENDIX F
EMI/EMC CONTROL, TEST PLAN AND DESIGN ANALYSIS REPORT

The report will include the details of the Attached Payload connected to Interface C electromagnetic effects control program. The control plan will be written to address, but not be limited to the following:

- An overview description of the Attached Payload connected to interface C.
- Designate an Electromagnetic Effects (EME) responsible organization.
- Schedules and milestones pertaining to EME related design and test activities.
- Planned facilities for EME testing.
- Identification of the line-item deliverable hardware including identification of the end item specification.
- Identification of the first level suppliers of components, subsystems, and systems that comprise the deliverable hardware and the applicable end item specification for each item.
- An overview description of each line-item deliverable hardware including installed systems and subsystems.
- Description of general approach for meeting EMC requirements

Note: To accomplish the required analyses after a subrack payload change out (new, re-flight, or series), all of the original subrack test data will be required. This includes conducted and radiated emissions data, conducted and radiated susceptibility data, grounding and isolation data, and bonding data.

DESIGN ANALYSIS REPORT:

This portion of the data item will insure that station EME interfaces will be met and the Attached Payload connected to Interface C are built to be self-compatible. The Design Analysis Report will be written to address, but not be limited to the following:

- Identification of electrical processes, electrical bond resistance, dissimilar metal treatment methods, and other fabrication design features to insure bonding requirements of SSP 30245 will be met.
- Grounding design philosophy that insures grounding requirements of SSP 30240 will be met.
- Identification of any perceived problem areas in meeting the EME requirements.
- Identification of any transmitters and means of maintaining EMC.
- Cable design including wire categorization criteria for identifying, labeling and installing interference generating or susceptible wires, shielding techniques, and wire routing. This includes meeting SSP 30242 requirements at the interface and defining the wire routing within Attached Payload connected to Interface C with the necessary test and analysis to show that cable coupling will not be a problem within the Attached Payload connected to Interface C when payloads are integrated.
- Equipment, subsystem, etc. electrostatic discharge design features, and verification methods.

- Lightning protection (magnetic field protection) design features if powered in the Orbiter.
- Electrical/electronic EMI control and suppression techniques.
- Identify critical circuits and margin verification techniques.
- Plan for payload requirements that insure payload compatibility and station interface EMI requirements are met per SSP 30237 when Attached Payload connected to Interface C is integrated with its payloads. This should include analysis of EMI test data as it becomes available.
- Corona design considerations.

EMC TEST PLAN/REPORT:

PURPOSE: The EMC Test Plans/As Run Procedures/Reports will be used for the measurement of the electrical, electronic, and electromechanical characteristics (compatibility, bonding, grounding) of the deliverable end item (highest level deliverable).

SCOPE: The EMC Test Plan/As Run Procedure/Report will describe the plans/procedures to be used in EMC testing of deliverable end items.

DESCRIPTION: The Plan/As Run Procedure/Report will give the details of the functional compatibility demonstration that will include, but not be limited to, the following and will include a matrix that maps these items to the test plan/procedure:

1. Title Page: The title page will contain the following information:
 - a. Name and Nomenclature of systems
 - b. Name of Manufacturer
2. Table of Contents
3. Introduction: The EMC Test Plan/As Run Procedure/Report will contain an introduction that covers the following:
 - a. The purpose of the plan/procedure and its relationship to the overall EMC program for the flight element, system, etc.
 - b. Description of the flight element or system.
4. Applicable Documents
5. Test Site: A description of the test site, covering the following:
 - a. Description of test facility, shielded enclosure or anechoic chamber (size, plane waves).
 - b. Description of plans used to ensure that the electromagnetic ambient environment at the test site will not affect the validity of the tests.

6. Instrumentation: Test instrumentation to be used will be described as follows:
 - a. Complete description of EMC instrumentation for measuring electrical, video, and mechanical outputs of equipment and subsystems to be monitored during the testing.
 - b. The characteristics of any other equipment used including matching transformers and band-reject filters, antenna factors of specified antennas, and transfer impedance's of current probes.
7. Test Set-Up: A description of the test set-up will include the actual physical layout of the hardware. In addition, the Power source characteristics (output and impedance, regulation, voltage and current) necessary to operate the unit under test will be described.
8. The plan/procedure will include the following details on critical circuits and Bridge Wire Actuated Devices (BWAD).
 - a. Critical circuits
 1. Methods used to identify critical circuits
 2. Methods used to verify safety margins
 - b. BWADs
 1. Methods used to simulate BWAD's
 2. Methods used to test BWAD systems
 3. Methods used to verify safety margins
9. Test Operation: The description of the testing operation will cover:
 - a. Procedures for developing failure criteria and limits.
 - b. Test conditions and procedures for all electronic and electrical equipment installed in or associated with the Attached Payload and the sequence for operations during tests, including switching. This should be part of the step-by-step test procedure.
 - c. Implementation and application of test procedures which include modes of operation and monitoring points for each subsystem and equipment.
 - d. Means of testing design adequacy for electrification (static electricity) and lightning protection.
 - e. Electrical power voltage limits and methods for monitoring alternating current and direct current power buses to assure voltages are within the proper limits.

- f. Descriptions of arrangements for simulating operational performance in cases where actual operation is impractical.
 - g. Adjustments and settings of variable controls such as audio gain, video gain, sensitivity, squelch setting, etc.
 - h. Details concerning frequency ranges, channels, and combinations to be specifically tested such as images, frequencies, local oscillator, and transmitter fundamental and harmonically related frequencies. Subsystem susceptibility frequencies identified during laboratory testing will be included.
 - i. Identification of simulated signal inputs such as Doppler, radar altimeter, etc.
10. Evaluation: The plan/procedure will include the basis and methodology for evaluating test results including as a minimum, the following:
- a. Use of approved results from laboratory interference tests on subsystems and equipment.
 - b. Evaluation and degradation criteria for each flight rack and equipment under test.
11. Data Sheets: The plan/procedure will include data sheets for recording data of each test. The data sheet will also include requirements' values with tolerances wherever applicable. The paragraphing of the data sheets will correspond to the paragraphing of the test procedure. Provisions for recording the data, the test performed, signature of the tester, signature of the inspector, and serial number of the equipment will be included. In addition, the data will be presented in graphical form wherever applicable.

EMI TEST PLAN/REPORT:

PURPOSE: Ensure that the equipment level design is self-compatible and has accommodated EME design requirements.

SCOPE: The test procedures establish the step-by-step methodology that will be used for the measurement and determination of the electromagnetic interference characteristics (emissions, susceptibility, bonding, grounding and Electro Static Discharge (ESD)) of each item test. Each item tested will have an individual qualification test report and plan/as run procedure. Test reports and plans/as run procedures may be combined if the items tested are by design interconnected to form a subsystem (rationale for combining test plans must be included in the test plan).

DESCRIPTION: The EMI test report and plan/as run procedure will conform to the content and format requirements described below:

- 1. Title Page: This title page will contain the following information:
 - a. Name and nomenclature of Equipment

- b. Name of Manufacturer Information concerning the number of pages will be placed on the lower half of the page. Revision page information will be included if appropriate (applicable to the submission of revision pages).
2. Table of Contents: Follows the title page.
3. List of Abbreviations and Acronyms: This list will include all abbreviations and acronyms, as well as their definition, that are used in this test procedure.
4. Applicable Documents: will be listed as follows:
 - a. NASA
 - b. other

Introduction/Test Plan:

The EMI Test Plan will contain an introduction that will cover the following:

1. The purpose of the plan and its relationship to the overall EMI program for the tested item. A test schedule and list of responsible engineers will be included.
2. A table listing all the tests to be performed, the applicable requirement references, and test methodology.
3. Description of test sample, including operating frequency, line current.

Test Site:

A description of the test site, covering the following:

1. Description of test facility, shielded enclosure or anechoic chamber (size, plane waves).
2. Description of ground plane (size and type) and methods of grounding and bonding test samples in order to simulate actual equipment installation.
3. Evidence of spot-check measurements of the ambient electromagnetic emission profile of test facility, both radiated and conducted emissions, to determine ambient suitability.

Test Instrumentation:

1. Test equipment nomenclature, applicable characteristics, and calibration date.
2. The characteristics of matching transformers and band-reject filters.
3. Antenna factors of specified antennas and transfer impedance's of current probes.

4. Impedance of Line Impedance Stabilization Networks and insertion losses and impedance curves of 10 microfarad capacitors.
5. Information on calibration of test equipment, as well as any general information deemed necessary for calibration of test conditions and procedure, will be included.

Test Set-Up:

A general description of test sample set-up will include the actual physical layout of the equipment under test, the position of the feed-through capacitors of line impedance stabilization networks on the ground plane and the location of bond straps, loads, and test sets. (Notes may be used to indicate height above ground plane for loads.)

Test Sample Operation:

The description of the test sample's operation will cover:

- A. Modes of operation for each test.
- B. Control settings on the test sample.
- C. Control settings on any test sets employed or characteristics of input signals.
- D. Test frequencies at which such devices as oscillators and clocks may be expected to approach requirements and limits.
- E. Performance check initiated to designate the equipment as meeting minimal working standard requirements and limits.
- F. Circuits, outputs, or displays to be monitored during susceptibility testing will be enumerated, as well as the criteria for monitoring performance.
- G. Normal, malfunction, and degradation of performance criteria for susceptibility testing.

Measurements and Methodology:

The measurements that demonstrate compliance with the requirements will be described. As a minimum, the following will be indicated for each test:

- A. Block diagram depicting test setup.
- B. Test equipment used in performance of the test (including calibration data), and the methods of grounding, bonding or achieving isolation for the measurement instrumentation.
- C. Procedures for (1) probing the test sample, (2) determining placement and orientation of probes and antennas, and (3) selecting measurement frequencies and detector functions.

4. Information to be recorded during the test, including frequency and units of recorded information. Sample data sheets, test logs and graphs, including test limits, will be shown. All data whether below or above specification level will be shown.
5. Modulation characteristics of the susceptibility test signals, such as amplitude, wave form, and type of modulation.

Test Procedure:

Test Conditions - The conditions will include pictorial diagrams of the equipment setup that identify each piece of equipment, its orientation, and relation to other equipment. The pictorial diagrams will clearly identify each piece of equipment to be utilized and the reference designation of connectors and interconnecting cabling.

Data Sheets:

Data sheets will be included for recording data of each test. The data sheet will include specification requirement values with tolerances wherever applicable. The paragraphing of the data sheets will correspond to the paragraphing of the test procedure. Provisions for recording the date the test was performed, signature of the tester, signature of the inspector, and serial number of the equipment must be included. In addition, the data will be presented in graphical form to enhance reader comprehension.

The EMI Test Report will conform to the format requirements described below:

- A. Administrative Data: The EMI Test report will contain an administrative section covering the following:
 1. Name and nomenclature of items tested;
 2. Name of manufacturer;
 3. Authentication and Certification of performance of the tests by qualified representative of the procuring activity;
 4. Disposition of the test specimen;
 5. Description of the test sample, including function and intended use or installation;
 6. List of tests performed and changes in limits or test frequencies previously authorized; and
 7. Any approved deviations to the test plan procedures.
- B. Test Results: Each test section will cover the applicable test procedure. The log sheets will be contained in a separate appendix. The test results section will contain the following data:
 1. Photographs or diagrams of test set up and test sample with identification

2. Graphs of applicable limits and measured data in units as specified in the requirements.
3. Data to show compliance with susceptibility requirements and thresholds of susceptibility or limitations of test equipment.
4. If suppression devices are employed to meet the requirements, they must be identified, using schematics, performance data and drawings.
5. Sample calculations, if any.

C. Recommendation and Conclusions. Recommendations and conclusions, including results of the tests in brief narrative form, a discussion of remedial actions already initiated and proposed corrective measures that will be implemented to ensure compliance of the equipment or subsystem, with the EMI requirements.

APPENDIX G**ELECTROMAGNETIC EFFECTS/ELECTROMAGNETIC COMPATIBILITY TEST DATA FORMAT**

Data shall be provided on electronic media in ASCII format for integrated EMI/EMC assessments. Per paragraph 3.1.2.3.4 of SSP 30238, required data accuracy is +/- 1% of frequency and +/- 1.5 dB amplitude for each EMI/EMC test. Data shall be recorded with a frequency resolution minimum of 235 data points per decade to a maximum of 10,000 points per decade. Data may be provided in linear decade groupings (1000, 1010, 1020, 1030... 9980, 9990, 10000, 10100, 10200, ... Hz typical) if log frequency recording is not available.

Frequency Domain Data

The data format for ASCII recording shall be:

Frequency, <tab>,Amplitude,<carriage return/line feed>

Frequency shall be recorded to a minimum of four significant digits, plus exponent.

Amplitude shall be recorded to a minimum of three significant digits, plus exponent.

Emissions exceeding the limits of SSP 30237 for frequencies above 100 MHz shall be recorded to a frequency accuracy of .002% per 3.1.2.3.4 of SSP 30238. These data shall be provided on electronic media in separate ASCII formatted files in the following format:

Lower Edge Frequency, <tab>, Amplitude, <carriage return/line feed>

Frequency 2, <tab>, Amplitude, <carriage return/line feed>

Frequency 3, <tab>, Amplitude, <carriage return/line feed>

High Edge Frequency, <tab>, Amplitude, <carriage return/line feed>

Where Lower Edge Frequency is a frequency at or below the onset of excessive emissions and High Edge Frequency is a frequency at or above a band of excessive emissions. Very narrow band emissions which do not overlap .001% frequency boundaries may be recorded as a single frequency and amplitude.

Minimum frequency resolution shall be 0.001% of frequency for log frequency data or .001% of low decade range in linear decade groupings (1234.1, 1234.2, 1234.3...1234.8 Hz typical)

Time Domain Data

Recorded time domain data shall be required for emissions exceeding limits 50% of limit. Representative data shall be provided for each transient type having noticeable time constant differences or differences in waveform.

ASCII data is to be recorded in the following format

Time, <tab>, Amplitude, <carriage return/line feed>

where time is recorded in sufficient resolution to record a minimum of 1024 points for the duration of the transient or a maximum sample rate of twice the specified bandwidth minimum (40E6 for CE07 or 20E6 for CS06), whichever sample rate is less.

Applicable tests requiring electronic media data recording, referenced by paragraph number in SSP 30238, are as follows:

Analysis Type	X (Frequency) and Range	Y (Amplitude) Units
+CE01	30 Hz to 15,000 Hz	dB microamps
-CE01	30 Hz to 15,000 Hz	dB microamps
+CE03	15,000 Hz to 50,000,000 Hz	dB microamps
-CE03	15,000 Hz to 50,000,000 Hz	dB microamps
+CE07	0.01 to 1,000,000 microseconds	volts from nominal
-CE07	0.01 to 1,000,000 microseconds	volts from nominal
+CS01	30 Hz to 50,000 Hz	volts rms
-CS01	30 Hz to 50,000 Hz	volts rms
+CS02	50,000 Hz to 50,000,000 Hz	volts rms
-CS02	50,000 Hz to 50,000,000 Hz	volts rms
+CS06	0.01 to 1,000,000 microseconds	volts from nominal
-CS06	0.01 to 1,000,000 microseconds	volts from nominal
RE01	30 Hz to 50,000 Hz	dB picoTesla
RE02	14,000 Hz to 10,000,000,000 Hz	dB microVolts/meter
RS01	30 Hz to 50,000 Hz	dB picoTesla
RS02	0.01 microsecond to 1,000,000 microseconds	volts from nominal
RS03	14,000 Hz to 50,000,000,000 Hz	volts/meter

* + Indicates positive lead test